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THE PROCEEDINGS

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UNITED STATES NAVAL INSTITUTE.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME POINTS IN COAST-DEFENCE BROUGHT OUT BY THE WAR WITH SPAIN.*

By CAPTAIN CASPAR F. GOODRICH, United States Navy.

The events of our late struggle with Spain have been so completely described and analyzed by experts in naval and military science, by eye-witnesses and active participants, by journalists and historians, that further reference to them or to the lessons they convey can be made only after ample apologies on the part of the lecturer, and by kind permission of an audience whose patience is, doubtless, already strained to the point of rupture. It is with frank recognition of the disadvantages and embarrassment of my position that I venture to allude to certain aspects of that war which are calculated to yield to our consideration a large measure of confirmation of the stand heretofore assumed in our studies of coast-defence, as well as of encouragement as to our future immunity from attack.

It would be a presumptuous labor of supererogation to attempt to deal with the general strategy of that brief campaign, so well

*A lecture delivered at the Naval War College, August, 1900.

and so thoroughly has this been done by Captain Mahan, whose volume, entitled "Lessons of the War with Spain," should be attentively conned by naval officers. From the reading of this able and pithy work we gather, among other things, a fresh picture of the state of the public mind during hostilities, which is in striking accord with what was predicted in this very lecture-room two years before the war broke out. Captain Mahan says (p. 67): "The preposterous and humiliating terrors of the past months, that a hostile fleet would waste coal and ammunition in shelling villagers and bathers on a beach, we may hope will not recur." Captain Mahan's hope will not be realized. The phenomenon will assuredly reappear whenever war is declared, just as it has invariably appeared in the past, for it is based upon the immutable processes of human nature. Its pernicious influence on the conduct of a campaign may be somewhat lessened through educating the people to a right conception of the ends sought in a military and naval conflict, and may be entirely overcome, if not dispelled, by stout resistance on the part of the administration.

Again he writes (p. 89): "'Our seacoast,' said a person then in authority to the present writer, 'was in a condition of unreasoning panic, and fought to have little squadrons scattered along it everywhere, according to the theory of defence always favored by stupid terror.' The 'stupidity,' by all military experience, was absolute, unqualified; but the Navy Department succeeded in withstanding the 'terror'—the moral effect—so far as to compromise in the Flying Squadron; a rational solution, though not unimpeachable."

In a lecture on "Naval Raids," delivered at the War College in 1896 and published in the PROCEEDINGS OF THE NAVAL INSTITUTE for June, 1898, the following expressions were employed in reference to the letters and telegrams received by the Navy Department in 1861, 1862 and 1863, containing, urgent if not frantic, appeals for ships to be stationed at various northern ports:

"It is impossible," this lecturer states, "in reading the letters and telegrams quoted above, not to admire the wisdom and firmness displayed by the Secretary of the Navy. A weaker man could not have withstood the popular clamor arising in every seaboard town for local protection, but would have divided our

too scanty forces and have made the less important points secure at the sacrifice of the larger, the vital interests at stake. Mr. Welles' contention was, in effect, that the harbors of New York and Boston were guarded by the blockading fleet that stretched from Cape Henry to the Rio Grande, a surprisingly broad and sound strategic view, from which he appears never to have wavered. This view, the very essence of correct coast-defence, stood successfully the test of years of war. Given fresh conditions not too unlike the old, it will still prevail. Yet, to-day we have on all sides a noisy demand for harbor-defence vessels and batteries of 16-inch guns on every salient."

"Whether, in the event of war in these days, a Secretary of the Navy can possibly be as independent in his action as was Mr. Welles, it is difficult to say. The question is of great importance to us, although it hangs rather upon the sociological development of the country than upon naval policy. Personally, I am disposed to fear that the powers of the press and the politician will, together, overbear the Secretary and force him into abandoning, not the true faith itself, but its practice. It is incumbent upon all who seriously discuss the naval problems of the future to recognize the possibilities for evil which may, and doubtless will, flow from the source so clearly defined in these extracts from the history of the past."

Captain Mahan attributes to a lack of coast-defences, meaning, presumably, harbor-defences, a faulty disposition of our naval strength at the outset. This is what he says (p. 53): "The unsatisfactory condition of the coast-defences, whereby the navy lost the support of its complementary factor in the scheme of national sea power, imposed a vicious, though inevitable, change in the initial campaign, which should have been directed in full force against the coast of Cuba." Possibly, Captain Mahan had confidential information on the subject not accessible to the general public, but the open records do not describe so backward a state of affairs.

It will be my endeavor in the following remarks to show that our brethren in the army had not been behind hand in their labors, and that our harbor-defences, although not developed to the vast extent recommended by the Endicott Board at a time when we had practically no navy at all, were entirely adequate to the task of deterring the Spaniards from attacking any point

worthy of strategic consideration or tactical effort. That a dread approaching panic existed along our seaboard was notorious at the time and is notorious now, but that it was justified by any lack of readiness or power on the part of either the army or the navy, I am not prepared to admit. We were fairly ready, in both services, and Spain knew it. This is the reason, and the inference is a fair one, why, in studying prospective hostilities with the United States, Spanish writers said never a word about carrying the war into America, and why Cervera, conceded to be the most thoughtful and accomplished of his cloth in Spain, and Concas, his able chief of staff, are not known to have examined into even the possibility of such a movement; certainly, they never counselled it.

Says Wilson, in his "Downfall of Spain" (p. 88):

"It will be observed that both these officers are for the virtual abandonment of Cuba and for a policy of complete inaction. Neither as much as suggests raids against the American coast-line. . . . It is strange that neither mentions the bombardment panic which was at this time very prevalent on the seaboard of the United States, or considers that if public opinion would recall the Spanish squadron, did an American fleet appear off the Spanish coast, it might equally well be expected to compel the recall of the American fleet, did the Spanish squadron appear off the coast of the United States."

How could they, when the Report of the Chief of Engineers of the United States Army for 1897 was at their disposal, with its calm and impressive statements of what had been done up to June 30 of that year, what it was expected to finish by December 31, 1897, and what further works were projected or under construction? Naturally, these statements were general rather than specific, and were, properly, so guarded in their phraseology that exact locations and gun commands were not revealed. Still, they could not fail to give a solemn warning to any possible enemy that, at every important seaport, very dangerous modern weapons were mounted, in addition to old guns in masonry works and to the planted mines, which might reasonably be assumed to play an active part in the general military defence.

As to the number of smooth-bore guns and 8-inch converted rifles in readiness for service when the war broke out I have no precise knowledge. We are all aware, in a general way, that

such guns, although mounted in the past, are not infrequently retained in position, pending the completion of the modern batteries which are eventually to replace them. As a rule, they are not removed unless, or until, their sites are required for the new works.

The frankness with which we publish to the world at large information that other nations are most careful to conceal, has often been commented upon at home and abroad. In this instance, it would appear that the practice was beneficial in its results rather than detrimental, so far as the non-combatant public was concerned. To prove a negative is proverbially difficult, and the argument *post hoc ergo propter hoc* is never regarded as conclusive. What the Spaniards *might* have done, had not the Chief of Engineers published his report for the fiscal year ending June 30, 1897, is as promising a theme for speculation as the color of Venus' hair or the number of angels that can stand upon the point of a needle. Let us leave it to the casuists. This, at least, we *do* know, that the report was made, was freely accessible to the Spaniards, and that, in fact, they did not operate upon our coast. We surely cannot deny to our gallant foe of the late war the wisdom that counselled the acquiring of all possible information on the subject of our fortifications, especially when that information was exact, official and public. Nor can any one be blamed who believes that the report itself and the Spanish plan of campaign stood somewhat in the relation of cause to effect, however unable he may be to demonstrate beyond peradventure the existence of such a relation.

There is, of course, one point wherein our ignorance was marked. We credited Spain with a close approximation to the full paper value of her fleet. We did not know how lamentably deficient in readiness were the units of that fleet, nor how destitute she was of the material resources required to make the fleet a satisfactory weapon. We erred on the right side, however, for it is never well to underestimate one's adversary. But, granting that the Spaniards were as formidable in reality as the information at our command represented them to be, I am still of opinion that our fears that they might work damage on our coast were groundless. Also, I am quite ready to admit that, to a certain extent, the unsatisfactory condition of the Spanish navy entered as an actual factor in keeping Cervera away from our shores,

while yet holding the view that, had it been what we thought it to be, he would none the less have failed to visit us.

Looking back upon the events of the spring of 1898, even without that full knowledge which we now possess of what did happen, I think we should have been entirely justified in trusting the protection of our seaports to our harbor-defences and in employing the fleet in strict accordance with the strategic demands of the situation.

The engagement at San Juan, Porto Rico, and the frequent shellings of the batteries at Santiago have not taught us sailors to despise the value of guns on shore, even if they be of small calibre, like the Spanish 15-cm. B. L. R's and 24-cm. howitzers. Bear this in mind when you ask, "But were our fortifications formidable enough to give pause to the Spaniard?" and bear in mind that the 8-inch converted rifle (a very efficient weapon it is, too) was commonly found in our older works associated with smoothbores, some of which are of 15 inches in calibre.

From the condition of the problem it was not expected that our own fleet should take the rôle of the defence. We were too strong and were practically in home waters. The stationing of monitors here and there, of the Katahdin at Provincetown, and the formation of the patrol squadron, were concessions to popular clamor. They were not operations in coast-defence and should not be dignified with such an appellation.

The relief experienced by the public at home when news came of Dewey's action at Manila should suffice to prove the soundness of the view generally taken by naval authorities on the subject of war, especially by those of the English-speaking races—that in the navy lies our true coast-defence.

Says Sir George Clarke in Brassey (1899, p. 141): "Now, as always, ports containing essential naval resources or required for the protection of a commercial marine, require defence against naval raids, but the real protection of a coast-line must continue to depend on the mobile navy. The sum which a nation can spare for naval and military purposes is practically limited, and all superfluous expenditures upon coast-defence entails loss upon the sea-going fleet and the field army which are the real arbiters of war. . . . Americans who have marked the vigor and the initiation, the skill and the daring displayed by their navy in the recent war, cannot fail to understand where lies the true defence of their coast-line."

This view was practically expounded by Howard in 1588, by Torrington in 1690, by De Ruyter in 1672 and 1673, by Howe on our own coast in 1779, by Nelson in the early years of the nineteenth century, by Gideon Welles in 1861 and 1863, by Dewey and Sampson in 1898. Shall we not preach it and enforce it until the truth be recognized far and near?

To prove that we were by no means badly off in our harbor-defences, I give a brief summary of their condition drawn from official sources. The detailed exhibit may be consulted in the appendix to this article. Here, then, is a list of what we really had.

The *Penobscot and Kennebec* rivers were mined and defended by old works and old guns, some of 15-inch calibre.

Portland, Me., had old works, mines and the following new guns: in June, 1897, three 10-in. emplacements ready, two carriages and four guns delivered; June, 1898, five 10-in. guns mounted.

Portsmouth, N. H., had, in June, 1898, old works, mines, and two 8-in. guns mounted.

Boston had old works and mines. In June, 1897, there were sixteen 12-in. mortars, three 10-in. emplacements, essentially completed, and the armament delivered and being mounted; in June, 1898, of modern guns, eight 10-in. rifled guns and two R. F. guns were ready for service, in addition to the mortars.

Narragansett Bay had three works of older type and was closed by mines. In June, 1898, sixteen 12-in. mortars and two 10-in. guns.

New York, Eastern Entrance, had a number of masonry works of old types. In June, 1897, there were sixteen 12-in. rifled mortars, two 10-in. guns. By June, 1898, an 8-in. gun was also mounted and mines planted.

Staten Island had old works. In June, 1897, five 8-in. rifles ready. By June, 1898, in addition, four 10-in. guns, two 4.7 R. F. guns were ready and the Narrows mined.

Long Island had, apparently, on January 1, 1898, three 10-in. rifles and six rapid-firers. By June 1, 1898, a fourth 10-in. rifle would appear to have been in readiness.

Sandy Hook, by January 1, 1898, had old works, sixteen 12-in. mortars, two 12-in. rifles, two 10-in. rifles. By June, 1898, two more 10-in. rifles, two 4.7 R. F., three dynamite guns and lots of submarine mines.

Delaware River, masonry work of old style, June, 1897, and three 10-in. guns ready. June, 1898, three 10-in., three 12-in., two 4.7 R. F. and submarine mines were ready.

Baltimore, June, 1897, two old works. June, 1898, eight 12-in. mortars, one 12-in. and three 8-in. guns; the channel mined.

Washington, June, 1897, two works of old type, three 10-in. guns. June, 1898, five 10-in., one 8-in. guns and submarine mines.

Hampton Roads, June, 1897, two old works, one partially completed; three 10-in. guns and sixteen 12-in. mortars practically ready. June, 1898, in addition, a 10-in. gun, four 8-in. guns and three rapid-fire guns, 108 submarine mines.

Wilmington, N. C., June, 1897, one old work. June, 1898, four 8-in. guns and submarine mines.

Port Royal, S. C., June, 1898, two 4.7 R. F. This is the only place containing a naval station where the shore works were insufficient to repel a serious attack. On the other hand, what possible end could have been gained by the Spaniards had they ventured over the bar and reached a safe anchorage within? The safety of Port Royal was completely assured by its lack of strategical value. As against a mere raid the two quick-firing guns were entirely adequate.

Savannah, June, 1897, three old works. June, 1898, four 8-in. guns, two 4.7 guns, one 8-in. temporarily mounted. Forts Pulaski and Clinch in condition for service. Submarine mines.

Key West, a masonry fort with two 15-in. S. B., and ten 8-in. converted rifles. Mines. As the modern guns contemplated were not mounted, it may be inferred that they were not regarded as necessary.

Pensacola, two masonry works of old type, three 8-in. converted rifles. June, 1897, two emplacements for 10-in. guns ready. June, 1898, four 10-in., two 4.7 guns and submarine mines.

Mobile, June, 1897, two emplacements for 8-in. rifles ready, two almost ready. June, 1898, eight converted 8-in. rifles and four modern 8-in. guns, and two 4.7 guns, mounted. Submarine mines.

New Orleans, two masonry works of old type. June, 1897, nothing modern completed. June, 1898, one 8-in. converted rifle and seven 15-in. S. B., two 10-in. and two 8-in. modern guns and submarine mines.

Galveston, June, 1897, nothing modern. June, 1898, one 10-in. gun, eight 12-in. mortars and submarine mines.

Parenthetically, I submit, with all due respect, that Galveston would be safer without any defences at all. It is now a fortified place and can no longer claim exemption from bombardment.

As I run over this really formidable array of submarine mines and guns, ancient and modern, which were in readiness to welcome Cervera (I can find no better term), I confess to being unable to comprehend our own lack of confidence in our harbor defences.

As the Chief of Engineers was well along in his preparations, so was the Chief of Ordnance in the equally important matter of guns and ammunition. As to the guns, it is not to be imagined for a moment that his estimate for a date so important as June 30, 1898, can be very far wrong. This estimate gives 384 modern guns, of which 235 guns and mortars were of 12-in. calibre, as mounted along our shores. From this number should be subtracted those mounted on or allotted to the Pacific coast, 43 in all, and we see that 341 modern guns of large calibre were practically in readiness to meet any demonstration which the Spanish fleet cared to make on the Atlantic seaboard. Add to this showing the dynamite guns at New York, and the unstated but very large number of old-fashioned weapons, in which an excellent weapon, the 8-inch converted rifle, figures prominently, and we have a really formidable array of artillery, entirely effective against Cervera's squadron. All this, too, without taking account of the shoals of submarine mines.

Again, making due allowance for the guns of this category which were mounted during June, 1898, we still see that our coast was not only far from unprotected when Cervera sailed from St. Vincent, but was indeed so strongly armed, if we may judge from published correspondence, that, as has been said, it never entered into his head to suggest operation against our ports.

That there was panic among the denizens of our Atlantic States is a fact, but this panic was not justified by the paucity of our coast-defences, as has just been shown. Our brethren of the army had done their work too well and no such paucity existed.

Nor can it be urged that there was any lack of ammunition.

The Chief of Ordnance, U. S. Navy, says (report 1898, p. 53): "There was procured by the beginning of the war, a considerable

quantity of charcoal and smokeless powder which, with the powder on hand, brought the supply up to a reasonably safe point." As to projectiles, the same officer stated that "the Department had provided the following projectiles, which were mainly on hand, though a few were still under manufacture for the 67 8-inch, 82 10-inch, 18 12-inch guns, and 217 12-inch mortars (384 in all) that would be mounted in the fortifications by June 30, 1898, viz.:

"For 8-inch guns, 9 rounds of steel and 9 of cast-iron projectiles per gun.

"For 10-inch guns, 19 rounds of steel and 4 of cast-iron projectiles per gun.

"For 12-inch guns, 43 rounds of steel and 41 of cast-iron projectiles per gun.

"For 12-inch mortars, about 10 rounds of steel and 3 of cast-iron projectiles per gun."

"By June 30, 1898, the following quantity of projectiles was on hand or under manufacture for the number of cannon of different calibres above stated, viz.:

" 8-inch guns, 61 steel and 19 cast-iron projectiles per gun,
" 10 " " 65 " 21 " " "
" 12 " " 150 " 47 " " "

" 12-inch mortars, 32 steel and 9 cast-iron projectiles per gun.

"A total of 80 projectiles per gun for 8-inch guns, 85 for 10-inch guns, 197 for 12-inch guns, and 41 for 12-inch mortars." (C. O., 1898, p. 54.)

The amount of projectile per gun at the outbreak of the war was undoubtedly too small, but the energetic measures taken by the Ordnance Office made prompt remedy. If, on the first of June, the guns had only one-half the quota stated to have been available or nearly so on the 30th, and this is a reasonable assumption surely, it gives as a result:

40 rounds for 8-inch guns,
42 " " 10- " "
98 " " 12- " "
20 " " 12- " mortars.

The danger point would have been left far behind.

As in the case of the fortifications and gun emplacements, the details as to guns and ammunition are given in an appendix.

The fact that our harbor-defences were and are so extensive,

so powerful and so liberally supplied, being opposed to the notion generally held on the subject, I have not ventured beyond the limits of official statements.* The fact will probably come in the first nature of a surprise to others as it did to me, for I had supposed, from utterance by the exponents of what the English followers of Captain Mahan call the "bricks-and-mortar school," as well as from Captain Mahan's own recent contribution to military literature, that our harbor-defences were in a bad way. I am glad to receive and to proclaim the official assurances that such was not at all the case. And I am also glad to be able to show that the things done, which Captain Mahan could not, as a strategist approve, were caused first, last and always by popular and unreasoning alarm.

Passing from the specific to the general, and omitting the Penobscot and Kennebec rivers, and Port Royal, where nothing existed to attract the attention of the Spanish and where the works, such as they were, were entirely adequate to the repelling of a naval raid or dash, it is, I think, quite within the limits of accuracy to assert that at every important point our fixed defences were more than strong enough to drive off the Spanish fleet, even if the Pelayo and Carlos Quintos had been added to Cervera's command, and that a serious attempt to reduce them would have subsequently entailed great labor and expense on the part of the Light House Establishment in marking, with buoys and light-vessels, the sites of Spanish wrecks off our coast.

It is to panic, pure and simple, that we must attribute the splitting up of the North Atlantic fleet and the formation of the Flying Squadron, panic on the part of the people, so extended and so acute that it was able to force the hands of the administration. What it did for the navy we all know. Fortunately the arrival of the Spanish squadron in the West Indies soon relieved the strain and no great harm was done.

But I think on shore great harm *was* done. The mounting of guns at Bar Harbor, Me., Bridgeport, Stonington, New Haven, etc., for example, is distinctly unfortunate. It teaches the people to trust to weapons that are out of place, that are of no use, and that may only serve to warrant a bombardment. Once admit

*As to the need of so elaborate a scheme of shore works, now that the country possesses a strong and most efficient fleet of battleships, I express no opinion.

that an enemy might by any possibility pay towns and cities of that size the flattery of a hostile visit, and you have started on the road which will bring you out at a continuous battery from Maine to Texas. At the same time you will have weakened the public confidence in our true coast-defence—the sea-going fleet. In his report for 1898, the Chief Engineer, page 29, says: "At the outbreak of the war, Sabine Pass was entirely undefended and became an object of solicitude lest its recently improved harbor be made the subject of a Spanish attack . . . temporary batteries for four siege guns were quickly constructed and the guns placed in position. . . . Provision was also made for mounting an 8-inch B. L. rifle. . . . Material for an improvised mine defence was accumulated, but the progress of events rendered planting mines unnecessary."

This case is typical. How could Cervera have possibly justified to his government a descent on Sabine Pass or have answered the question: "Que diable allait-il faire dans cette galère?"

Panic is unreasoning or it would not be panic. Upon us devolves the necessity of preaching, in season and out of season, the true doctrine that the wisdom and efforts of the two services may be trusted to do the best that can be done. To-day we may smile at our fears and laugh as we read that at San Diego, California, five triple groups of mines were planted, three 10-inch rifles mounted and that the battery commander kept two Napoleon guns trained on the mine field, "while," at San Francisco, "a number of mines were successfully planted before the end of the (fiscal) year."

A fairy tale of my own invention? Not at all; it is an extract from the report of the Chief of Engineers of the Army for 1898. Of what use in allaying general dread was Dewey's wiping the Spanish flag off the Pacific Ocean if the populace a month later could make capable and responsible army officers do such foolish things against their wills?

Said Sir George Clarke: "The Genesis of the Flying Squadron may in fact be traced to an uninstructed outcry;" also "By far the most important lesson of the war—to the United States and to Great Britain—is the danger that uninstructed public opinion may usurp the direction of naval policy."

So unreasoning is panic that it may be confidently asserted that

no sum of money, however vast, expended in military defences will in future relieve the Navy Department of the pressure of the demands for local floating defence or measurably decrease the apprehension in the public mind. If the experts in this branch are satisfied (as they should be) with the preparedness of our defensive works, it is time to announce the fact to our non-combatant countrymen and bid them quiet their fears. Those whose duty it is to protect them have not been negligent. Our forts are sufficiently advanced and our navy is equal, or will be so equal very shortly, to the rôle it should play in coast-defence. If this statement is incorrect, then official reports are of no value and we have read naval history in vain.

So convinced am I of the efficacy of our present fortifications that I am ready to go on record at this moment as believing that if not another gun were mounted than now are actually mounted no power in existence or that may arise in the next twenty years, would venture on a naval demonstration against any one of our principal sea ports. Herein lies the encouragement of which I spoke at the beginning of this lecture.

The lessons of history have to be repeated over and over again for they seem to fall on deaf or reluctant ears. Nor do the professors always agree.

Sir George Clarke says:* "Apropos of coast-defence, Captain Mahan has laid great stress on the paralyzing effect of inadequate coast-defence, but the lesson of the war is of an opposite character. Judged by any modern standard, the coast-defences of Cuba were miserable; but a moderately effective fleet based upon Cuban ports would have found them ample, and they may be actually said to have served their purpose. The term "coast-defence" in relation to a naval power is commonly abused and misunderstood. Ports containing essential naval resources, or serving as the basis of a commercial marine require small permanent defences sufficient to prevent a naval raid. How small these defences may be, Santiago shows. Half a dozen 6-inch Q. F. guns well mounted and well handled would have fulfilled every requirement. Towns situated on a long seaboard must take this chance. History shows that the defence of positions of this nature depends wholly upon sea power. If the naval conditions are such as to permit an enemy to attack them, it is the

* Brassy, 1899, page 172.

back door, the land front, which is invariably selected. The operations against Santiago supply only a fresh illustration of an ancient law."

That is to say, Clarke holds that ships would not attack strong places, but will cover the landing of an army to attempt the reduction of the works from the rear.

These are the lessons that I wished to force home, that fleets can not engage modern batteries except on fearfully unequal terms; that our worst foe is "uninstructed public opinion." The latter may be expected to again frustrate the intelligent efforts of our brethren of the army and to force upon us a faulty strategy unless we both manage, through a propaganda of enlightenment, to make it clear to all that the Army and Navy know their own business thoroughly and may be trusted to do for the people, when war comes, far better than the people can do for themselves. The two services have not, as yet, failed the country in its times of need. Until they do, they have a right not only to demand its confidence, but to enjoy that confidence to the fullest extent.

Appendix I.*

Penobscot River.—"The principal work done has been a partial cleaning of the old armament during the latter part of the fiscal year 1898. The fort was occupied by troops during a portion of the fiscal year." (C. E., 1898, p. 583.)

Kennebec River.—"During the fiscal year just ended, temporary wooden platforms for 15-inch guns have been constructed, and the carriages and guns mounted." (C. E., 1898, p. 584.)

". . . Mines were placed early in May in Kennebec and Penobscot rivers." (C. E., 1898, p. 15.)

Portland, Maine.—"The older type fortifications in the district have been kept in repair as far as the limited funds would permit." (C. E., 1897, p. 11.)

"Three of these emplacements (for 10-inch B. L. R's at Portland) were ready for their armaments at the close of the (fiscal) year, and all five will be completed during the present working season. Two carriages and four guns for these emplacements have been delivered.

* Extracts from Reports of Chief of Engineers (C. E.) for fiscal years noted. Bear in mind that the fiscal year ends on June 30.

"A mortar battery for sixteen 12-inch mortars (was commenced). . . . At the close of the (fiscal year) the excavation for this battery, which is all in ledge, was well advanced." (C. E., 1897, p. 12.)

Also, contracts had been made for the construction of two 12-inch emplacements here, to be finished December 1, 1897.

"Work was continued on emplacements for five 10-inch guns for the defence of Portland harbor, Maine. At the close of the year all of these were completed except a portion of the iron work, and all the guns were mounted." Page 15: "During April, 1898, mines were placed in three channels leading into Portland harbor." (C. E., 1898, p. 14.)

Portsmouth, N. H.—Two emplacements for 8-inch guns were contracted for, to be completed October 15, 1897. "The contract for Portsmouth harbor also includes the construction of a mining casemate." (C. E., 1897, p. 12.)

"The work is now nearly completed, and guns are mounted." (C. E., 1898, p. 15.)

". . . Mines were placed . . . early in May in Portsmouth harbor."

Boston.—"The mortar battery (sixteen 12-inch mortars) was completed in all its details, and has been transferred to the care of an artillery garrison. Three 10-inch emplacements are essentially completed and their armament delivered. This armament is being mounted by artillery troops, two carriages being in place at the close of the year. Four additional 10-inch emplacements are ready for their armament, although considerable work still remains to be done."

There are three works of older type, one used as a torpedo store house (p. 602). "One casemate for a rapid-fire gun (one of two 5-inch guns authorized) is completed with the exception of opening the port." (C. E., 1897, p. 12.)

"At the close of the previous fiscal year there had been provided . . . emplacements for eight 10-inch guns on disappearing carriages, a mortar battery for sixteen 12-inch mortars. . . . All the 10-inch emplacements were essentially completed at the close of the fiscal year, and all the guns mounted ready for service. The sixteen mortar battery has been in charge of the troops since July 25, 1896."

"At the close of the fiscal year two rapid-fire guns were mounted."

"In anticipation of the war with Spain, preparations were commenced early in April, 1898, for planting mines for the defence of Boston harbor. . . . A total of ten grand groups of service pattern mines were planted and maintained in effective condition to the close of the fiscal year." (C. E., 1898, p. 16.)

Narragansett Bay.—"The defences comprise three works of the older type."

"At the close of the (fiscal) year this battery (sixteen 12-inch mortars) was well under way, and platforms for twelve mortars completed and the base rings set."

"It is expected that the emplacements (for three 10-inch rifles) will be essentially completed at the close of the present working season." (C. E., 1897, p. 12.)

Both batteries were completed during the fiscal year, the armament placed in position for service, and the batteries formally transferred to the troops for use and care in June, 1898.

"The defences include two permanent masonry works of old type."

"During the months of April and May the entrance to Narragansett Bay were closed by mines and special rules for navigation put in operation." (C. E., 1898, p. 17.)

Eastern Entrance, Long Island Sound.—For two emplacements for 12-inch rifles, disappearing carriages, contract was made, "work to be completed November 1, 1897." "There is every reason to believe that the work will be completed on time." (C. E., 1897, pp. 13, 608.)

"The battery (12-inch) awaits its armament; a 4.7-inch gun (is) mounted ready for service." (C. E., 1898, p. 18.)

"For the defence of New Haven, temporary batteries for six 10-inch smooth-bore guns were constructed. . . . Similar temporary batteries were planted for four and one gun, respectively, were constructed at Bridgeport and Stonington. Submarine mines were planted for the defence of New Haven harbor." (C. E., 1898, p. 18.)

Eastern Entrance to New York Harbor.—"In addition to the new work begun during the year, the modern defences include a mortar battery for sixteen 12-inch mortars and emplacements for two 10-inch and one 8-inch guns, on disappearing carriages, which are essentially completed and armed, except the 8-inch emplacement, for which no guns or carriages have been received." (C. E., 1897, p. 13.)

The defences include a number of masonry works of old type.

"The armament of the two 10-inch emplacements and of the one 8-inch emplacement is in position for service."

"The channel was defended by 59 submarine mines planted in April and May." (C. E., 1898, p. 12.)

Staten Island.—Battery of five 8-inch rifles on disappearing carriages "is now complete." (C. E., 1897, p. 613.)

Four emplacements for 10-inch guns "were essentially complete and awaiting their armament." (C. E., 1897, p. 14.)

"On Staten Island four emplacements for 10-inch guns on disappearing carriages, nearly completed at the date of the last Annual Report, have been completed and armed."

"At the close of the fiscal year the rapid-fire emplacements (for two 4.7-inch R. F. guns) were completed and armed." (C. E., 1898, p. 19.)

Long Island.—It is difficult to determine from the Report of the Chief of Engineers the exact condition of these defences, but it seems probable, from the statement on page 615, that "emplacements Nos. 6 and 7 are ready for service in every respect," and that "emplacement No. 5 is completed ready for service, excepting the ammunition lift;" that at the close of the fiscal year 1897 there were mounted, and practically ready for use, on Long or Coney Island, three 10-inch rifles and six rapid-firers, probably 6-pdrs. (C. E., 1897, pp. 14, 614.)

Sandy Hook.—Prior to the fiscal year 1897 there were at this point a battery of sixteen 12-inch rifled mortars, also two 12-inch rifles. During that fiscal year there were completed five emplacements for 10-inch guns and four casemates for rapid-fire 6-pdrs., "except mounting a portion of the armament." (C. E., 1897, p. 14.)

At the close of the fiscal year 10-inch battery No. 1 of two guns "was complete in all details except the ammunition hoists." (C. E., 1897, p. 621.)

"During the year the four 10-inch emplacements were completed and armed." (C. E., 1898, p. 19.)

"At the close of the fiscal year, two rapid-fire emplacements were completed and armed with 4.7-inch guns." (Page 20.)

"Submarine mines were planted at the Narrows and at Sandy Hook entrance, about 250 mines having been placed in position." (C. E., 1898, p. 20.)

Apparently by the first day of January, 1898, there were at the southern entrance to New York at least the following modern guns, mounted and ready:

On Staten Island.....	Five 8-inch rifles,
On Long Island.....	Three 10-inch rifles,
	Six 6-pdrs.,
At Sandy Hook.....	Sixteen 12-inch mortars,
	Two 12-inch rifles,
	Two 10-inch rifles.

"On the outbreak of hostilities between this country and Spain, the Department at once placed in serviceable condition the pneumatic dynamite gun batteries located at the ports of New York and San Francisco. A supply of explosive gelatine was procured for filling the shell and arrangements made with the company for filling the shell and doing any needful work on the fuses which were in store." (Report of Chief of Ordnance, U. S. A., 1898.)

Delaware River.—"The main battery is practically completed. The three 10-inch guns are mounted in position and the three 12-inch guns can be mounted as soon as the guns and carriages are received." (C. E., 1897, p. 14.)

"It is estimated that two emplacements for 5-inch rapid-fire guns can be ready to have the guns mounted in them by August 15, 1897." (C. E., 1897, p. 635.)

"The defences include one masonry work of old type which was garrisoned for a portion of the year as a result of the war."

"The battery of six 10-inch and 12-inch disappearing guns is completed, the guns and carriages are mounted and the ammunition hoists, electric lighting system, cranes, etc., are in full working order."

"Two 4.7-inch rapid-fire guns, purchased in England, were received on April 23, 1898. Twelve days later they were mounted on temporary platform ready for service."

"Submarine mines for the defence of the Delaware were planted in April and May, 1898." (C. E., 1898, p. 21.)

Baltimore.—"Nothing modern completed but two old works still existing." (C. E., 1897, p. 15.)

". . . Emplacements have been provided for a battery of eight 12-inch mortars, a battery of one 12-inch and three 8-inch guns on disappearing carriages. . . ."

"These works were all completed and armed during the year. . . ."

"The channel leading to Baltimore was obstructed by submarine mines." (C. E., 1898, p. 22.)

Washington.—Three 10-inch guns on disappearing carriages were in place.

Emplacement for a fourth 10-inch gun and three emplacements for 8-inch guns were to be completed on September 1, 1897. (C. E., 1897, p. 15.)

"The defences include two works of old type."

"At the close of the fiscal year all the foregoing emplacements were completed and the guns mounted ready for service."

"The 10-inch gun on non-disappearing carriage, intended for testing the experimental parapet was mounted upon a temporary platform, so as to be available for service in case of an emergency."

"Submarine mines were planted in the channel." (C. E., 1898, pp. 22 and 23.)

Hampton Roads.—Three 10-inch guns and a battery of sixteen 12-inch mortars complete or practically so. (C. E., 1897, p. 16.)

Besides the foregoing, "operations were in progress upon an additional emplacement for a 10-inch gun on disappearing carriage, and for three emplacements for 8-inch guns on disappearing carriages. . . ."

"The defences include two inclosed masonry works of old type, one of which is only partially complete."

"During the year the mortar battery was finished and armed." "An 8-inch rifle . . . was mounted under cover of one of the mining casemates . . . making it part of the permanent project of defence." "Three (additional) 8-inch guns and three rapid-fire guns were mounted ready for service."

"The channel was obstructed by 108 submarine mines." (C. E., 1898, p. 23.)

North Carolina.—"The defences include three works of old type, two of which are in ruins."

". . . Emplacements for three 8-inch guns on disappearing carriages were . . . completed and armed during the year."

An additional 8-inch gun was also mounted.

"Submarine mines were placed in the Cape Fear River, at the outbreak of the war." (C. E., 1898, p. 24.)

Charleston.—"The modern defences consist of a mortar battery for sixteen 12-inch mortars and a gun battery for three 10-inch guns on disappearing carriages. . . . At the close of the fiscal year, the mortar battery was completed except the floors and drainage system, and sixteen carriages and eight mortars were mounted. Excellent progress has been made by the contractors for the gun battery, and at the close of the fiscal year the work was about six-tenths completed, with every prospect of its being finished before the close of the present working season. (C. E., 1897, pp. 17, 675, 693.)

"The defences include four old type works."

"During the year . . . the (mortar) battery (was) completed and all the armament placed in position."

"Four 10-inch guns on disappearing carriages were mounted by the artillery." (C. E., 1898, p. 24.)

"The entrance to Charleston harbor was defended by submarine mines." (Page 25.)

Port Royal.—"Two 4.7 rapid-fire guns were mounted here." (C. E., 1898, p. 25.)

Savannah and the Coast of Georgia, etc.—"The defences include three masonry works of old type."

At Savannah, presumably, "the battery of four 8-inch guns on disappearing carriages . . . was substantially completed and the guns mounted before the end of the year."

"Two 4.7-inch guns were mounted." (C. E., 1898, p. 25.)

"An 8-inch B. L. rifle on non-disappearing carriage was temporarily mounted . . . for the defence of Savannah. The existing old armament at Forts Pulaski and Clinch was overhauled, repaired, and put in condition for service."

"Submarine mines were planted for the defence of Savannah." (C. E., 1898, p. 26.)

"For the defence of Brunswick and Darien, Ga., and Fernandina, Florida, temporary batteries, mounting three 10-inch smooth-bore, six 100-pdr. Parrott, and four siege guns, were constructed at a number of entrances to the inside water route." (C. E., 1898, p. 26.)

East and West Coasts of Florida.—"Temporary batteries for mounting field and siege guns were built at the mouth of the St. Johns River, at St. Augustine, at Miami and at Tampa Bay."

"An emergency system of mine defence was provided for at the

St. Johns River, and preparation for placing mines in Tampa Bay were under way." (C. E., 1898, p. 26.)

Key West.—Four 10-inch and two 8-inch guns on disappearing carriages and eight 12-inch mortars to be mounted. The emplacements were to be completed January 1, 1898.

Also a mining casemate and cable gallery commenced. (C. E., 1897, p. 17.)

"The defences include one masonry work of the old type, in which . . . two 15-inch smooth-bores and two 8-inch converted rifles were . . . mounted."

"Submarine mines were planted for the defence of the harbor." (C. E., 1898, p. 27.)

Note.—The modern guns were not mounted as expected.

Pensacola.—Four emplacements for 10-inch guns on disappearing carriages "are ready for their armament."

It appears that there were three 8-inch converted rifles mounted on concrete platforms. (C. E., 1897, p. 18.)

"The defences include two masonry works of old type."

"During the year a battery of four ten-inch guns on disappearing carriages was completed in all details, the guns mounted and the battery transferred to the artillery for use and care."

Two 4.7-inch rapid-fire guns were mounted.

"Submarine mines were planted and maintained in condition for service." (C. E., 1898, p. 27.)

Mobile.—Four 8-inch rifles proposed.

"The first two emplacements have been ready for their armament some time; the second two will be ready in a few weeks." (C. E., 1897, p. 18.)

"Eight 8-inch converted rifles were mounted."

"A battery of four 8-inch guns on disappearing carriages . . . was substantially completed, and the guns mounted."

Two 4.7-inch rapid-fire guns were mounted.

"The entrance to the harbor was obstructed with submarine mines." (C. E., 1898, p. 28.)

New Orleans.—Nothing modern completed.

"The defences of New Orleans include two masonry works of old type. . . . At the outbreak of the war, one 8-inch converted rifle and seven 15-inch smooth-bore were mounted. . . ."

"Two 10-inch guns, on disappearing carriages mounted, also two 8-inch guns."

"Submarine mines were planted in the Mississippi River." (C. E., 1898, p. 28.)

Sabine Pass.—"At the outbreak of the war, Sabine Pass was entirely undefended, and became an object of solicitude lest its recently improved harbor be made the subject of a Spanish attack. . . . Temporary batteries for four siege guns were quickly constructed and the guns placed in position. . . . Provision was also made for mounting an 8-inch B. L. rifle."

"Material for an improvised mine defence was accumulated, but the progress of events rendered planting mines unnecessary." (C. E., 1898, p. 29.)

Galveston.—Two 10-inch guns on disappearing carriages.

"It is expected that the battery will be finished by August 31, 1897. (C. E., 1897, p. 19.)

"One gun mounted." "The mortar battery (eight 12-inch mortars) was substantially completed and the armament mounted."

"The entrance to Galveston harbor was obstructed by submarine mines." (C. E., 1898, p. 29.)

San Diego.—"Five triple groups of mines were planted at San Diego. Three 10-inch B. L. R's mounted between April 19 and May 23."

"The battery commander has two Napoleon guns trained on the mine-fields." (C. E., 1898, p. 30.)

San Francisco.—"A number of mines were successfully planted before the end of the year." (C. E., 1898, p. 31.)

Appendix II.*

Guns and Ammunition.—"Thus far the Department has been able to complete and furnish carriages as fast as the fortifications were ready for them." (C. O., 1897, p. 36.)

"In the sea-coast gun department the number of guns finished during the year was as follows:

Thirteen 8-inch,
Twenty-two 10-inch,
Seventeen 12-inch (C. O., 1897, p. 173),
One 10-inch disappearing carriage."

Six 12-inch mortar carriages, begun before, were fully completed.

* Extracts from the Reports of the Army Chief of Ordnance (C. O.) for the fiscal years noted. Bear in mind that the fiscal year ends June 30.

In addition, the following were completed during the year:

One 12-inch disappearing carriage,
Four 12-inch barbette carriages,
Five 10-inch disappearing carriages,
Five 8-inch disappearing carriages.

Also, not completed now, but will be ready for issue in the early fall:

Four 12-inch disappearing carriages,
Three 8-inch disappearing carriages,
Three 12-inch barbette carriages (C. O., 1897, p. 178).

"The following guns, mortars and carriages, of new construction, have been issued from this post (Sandy Hook) during the year, for installation in sea-coast fortifications built especially for their reception:

2 8-inch B. L. R.,
22 10- " "
6 12- " "
6 12- " " mortars."

36

6 10-inch disappearing carriages,
1 12-inch barbette carriage,
1 12-inch lift carriage,
6 12-inch B. L. mortar carriages.

"Also 35 mortar carriages (out of 57 contracted for) from Robt. Pool & Son Co."

"A second contract for 35 more, making 92 in all, to begin delivery in October, 1897, and finish end of April, 1898." (C. O., 1897, p. 21.)

"During the past year the following guns and mortars, of modern construction, have been issued from this post (Sandy Hook Proving Grounds) for installation in sea-coast fortifications, viz.:

34 8-inch B. L. R.,
36 10- " "
6 12- " "
69 12- " "

145

(C. O., 1898, p. 40)."

"Total number of sea-coast cannon and carriages mounted or estimated to be mounted at the date given," June 30, 1898:

4-inch Driggs-Schroeder carriages, with pedestal mount,	4
5-inch barbette carriage or pillar mount	1
8-inch barbette carriage, model 1892	8
8-inch barbette carriage (altered)	21
8-inch disappearing carriages, L. F. model of 1894	25
8-inch disappearing carriages, L. F. model of 1896	13
10-inch barbette carriages, model of 1893	5
10-inch disappearing carriages, L. F. model of 1894	34
10-inch disappearing carriages, L. F. model of 1896	43
12-inch barbette carriages, model of 1892	8
12-inch lift carriages, model of 1891	2
12-inch altered lift carriages, model of 1894	3
12-inch disappearing carriages, L. F. of 1896	5
12-inch mortar carriages, model of 1891	85
12-inch mortar carriages, model of 1896	132
Total	389

(C. O., 1898, p. 44.)

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

OUR NEED OF FIGHTING SHIPS.

By COMMANDER J. B. MURDOCK, U. S. N.

The first vital point affecting our policy of naval construction is that it should be adapted to the needs of the country. The time long since passed for us to buy plans abroad; we should now stop copying foreign designs. An exhaustive study of all European construction is of course a necessity and details may be copied with advantage, but the general plan of our ships should be not only distinctive, but designed for the accomplishment of whatever ends our navy may be called upon to perform.

While admitting the idea that our naval policy should dictate our construction, there may be much diversity of opinion as to what that policy should be. In the highest sense it depends on the foreign policy of the government, and is therefore beyond the sphere of our discussion as naval officers, but there is still much left to us, as our preparations should be such as to fit the navy in a general way for all eventualities, and we are neglectful of our duty if we fail to note and allow for every advance made by any naval power.

Let us examine the task which war with a first-class power would impose.

The theatre of future warfare between the great powers will be the world. Military campaigns will be carried on, but except on the continent of Europe, where large populations are associated in close contact, it will be impossible to assemble and operate the large armies characterizing the warfare of the last century. The military operations of the future are foreshadowed in the recent fighting in South Africa, China and the Philippines, and problems of transport and subsistence become vital. We should

drop forever the old hackneyed idea that the sea separates us from other powers. It does not; it brings us into contact with them. How could England have moved 300,000 men six thousand miles except on the sea? This great international highway, while nominally free to all, is in reality reserved to the strongest, and this question of strength is a purely naval one. A nation may have an invincible army and yet in war be restrained impotent in its own borders, if it has failed to provide in advance sufficient naval force to allow it to assert its claim to free transit at sea.

The events of the last decade have made the United States a world power in spite of itself. Our navy, which formerly had only to protect our coasts from naval attack, is now charged with the vastly more difficult task of keeping open the communications between isolated areas of American territory. As the battle of Manila decided the destiny of the Philippines, and that of Santiago made the loss of Cuba and Porto Rico a certainty to Spain, so a like reverse to our navy in a future war might cause a transfer of any of our outlying possessions to some other power. Military strength would be of no more avail than it was in Cuba in 1898, when, with their communications with Spain severed by the loss of Cervera's fleet, there was nothing in store for the 100,000 troops in Cuba but surrender or evacuation. In such cases military strength is but weakness, and the navy becomes the real support of national sovereignty.

We have seen in late years the transfer of large bodies of troops by sea, but this has taken place only when the transferring power has assured itself that there was no danger to fear in transit from an enemy's fleet. The Japanese landed troops in Korea before the battle of the Yalu, but not before they had satisfied themselves of their power to keep the Chinese fleet out of the way. The defence of a convoy is a matter of so much difficulty, and while inviting attack it is in itself so utterly defenceless, that a military expedition would hardly be sent to sea unless its security were guaranteed in advance by the seclusion or defeat of the enemy's naval force. Naval strength is thus a preliminary to military operations over sea, and must be maintained to insure transit of supplies. If lacking at any time, complete military failure may result.

The preceding arguments may not appeal to some of our citi-

zens, the anti-expansionists, who look upon our stepping outside our continental limits as an error and almost a crime, but even among the opponents of militarism there is a belief in the Monroe doctrine and many of them are earnest advocates of our control of the Isthmian Canal.

If there is any one feature of our foreign policy that has become ingrained in the thought of the nation, it is the Monroe doctrine. It apparently appeals to all shades of political opinion and to all classes of society. Any discussion of the principles of foreign policy involved is of course outside the sphere of this article. It is, however, a matter of common knowledge that the doctrine attracts considerable attention abroad and that frequent references are made to it in foreign publications. Without in any degree accepting or advocating these foreign views, they are necessarily interesting to all Americans, as showing how others see us and our affairs. As an example of foreign ideas on the subject, we find the following in the columns of the conservative London *Spectator*, of date of January 6, 1900:

The German Emperor is no enemy of America, but he has steadily fixed his mind upon a policy which runs directly counter to one of the chief maxims of American statesmanship, and he is now using the usual German "foresight" in order to make that policy practical. His demand for a fleet, and his insistence upon obtaining it, just as his grandfather insisted upon obtaining an army, is not based upon any vague and shallow idea of having a splendid plaything. Again, he does not want a fleet in order to get anything out of England, for he knows that he has already got out of us most of what he wants, and also that the destruction of our fleet would be too hard a nut to crack. He wants a fleet in order that when he puts his South American policy into operation he will not be made ridiculous by an order from Washington. Mark, he does not want to attack America in the very least, but merely to have the proper physical backing when he asks the United States not to play dog-in-the-manger any longer in regard to Spanish and Portuguese America. He believes that when he occupies the Rio Grande do Sul the Americans will waive the Monroe doctrine if his fleet is equal to or stronger than theirs. Was it not with such an idea in his mind that in his New Year's speech on the need of a navy he declared: "If any thing has to be done in this world the pen will be powerless to carry it through unless backed by the force of the sword?" Germany and the German Emperor want a fleet, then, not for parade or to flaunt in other people's faces, but in order to do something definite with it, and that something is making America give up what the Germans regard as her dog-in-the-manger attitude.

* * * * * * * *

When we speak of the German Emperor's South American Policy it must not be considered that we mean to imply that this is to be begun this year, or next year, or even in five years' time. It may be a very long time before the foundations of the new Empire will be laid, but meantime "foresight" is at work, and the work of preparation will be pursued. They will not be provocative, or in any sense essentially unfriendly to America, but they will be absolutely thorough. Now, under these circumstances, we think that America should look ahead, and not copy the policy of drifting which has so often proved injurious to the Old Country. That is, America should make up her mind whether she means, when the time comes, to insist rigidly on the Monroe doctrine. If she does not, and there are many very good reasons why she should abandon it, she need not trouble herself at all about German aspirations, for they will not injure her. After all, as the Germans argue, America does not want Brazil for herself, and therefore she need not mind Germany having it. There is no other point on which the Germans will touch her. Indeed, on all other matters Germany will show the utmost friendliness, not so say compliance, in regard to America. If, however, America really means business about the Monroe doctrine, and really thinks it is of importance to her national welfare to enforce it, she must not go to sleep. She must see to it, that is, that she has naval and military resources equal to the strain of maintaining a policy so tremendous. If not, she is certain to suffer a great humiliation at the hands of patient, efficient, and persistent Germany. Germany, when the hour comes, will not be "bluffed" into respect for the Monroe doctrine. She will "call" America's fleet, and if that fleet is not higher than hers Germany will act. If, however, it is superior America will never even hear of the danger to which the Monroe doctrine is now exposed. Let us say once again, we do not believe for a moment that Germany has any designs against the United States herself or bears her any ill-will. She is merely working steadily for an aspiration which comes in violent conflict with a certain American aspiration—the Monroe doctrine. Hence any one who likes to use his eyes can see that either the Monroe doctrine will have to be given up or its defence properly prepared for. Any halting between these policies must prove either disastrous or at any rate humiliating for the United States.

The same journal in another article on May 5, 1900, again referred to the Monroe doctrine:

Americans must make up their minds, and without delay, whether they mean to keep up the Monroe doctrine or to abandon it. If they mean to maintain it they must supply themselves with the necessary force. And they must remember that the force required will not be of a passive kind. It is no good for the Americans to talk about eighty millions of people, brave and rich and patriotic beyond example, being able to defend themselves against all comers, even without preparation. No doubt they can for home defense rely quite safely upon improvising an army. But this

kind of passive power gives no support to the Monroe doctrine. Let America rest assured that no power which wishes to challenge the Monroe doctrine will dream for an instant of invading America. What will happen when the Monroe doctrine is challenged will be something of this kind. Germany, to take a concrete example by way of illustration, will get into a dispute, say, with Brazil, and will prepare to occupy the southern provinces in order to protect her subjects and restore order. America will thereupon quote the Monroe doctrine, and then the Monroe doctrine will be quietly but quite firmly ignored. The next move will be America's. If she is strong enough she must send her Fleet wherever the German fleet is to be found and destroy it. If and when that is done, nothing will be easier to enforce the Monroe doctrine, for nobody can reach, much less hold, a part of Brazil or Central America without having the command of the sea—or at any rate the relative command of the sea. It comes, then, to this, that the Monroe doctrine must be founded on sea-power, and if America means seriously to enforce it against all likely comers, she must have a naval force capable of doing the work. But, clearly, if while Germany is building ships America is doing little or nothing, America will not be in a position to fetter Germany's will, or to tell her she shall not make what terms she likes with the South and Central American powers. And remember that America must do more than merely build. She must engage and train in sufficient numbers the men without whom the best ships are useless. Her present officers and men are as good as possible. They have superiors nowhere, and only equals in the sister-navy of Great Britain. But there are far too few of them, and a naval officer cannot possibly be improvised.

Another point on which there is a strong feeling among our people is that of an inter-oceanic canal. While there is by no means the interest in this that there is in the Monroe doctrine, there is unquestionably a widespread conviction that the United State has a greater interest in the canal than any other nation and should therefore "control" it. Control of an international thoroughfare, such as the canal must be when finished, is a very delicate question. While it might appear perfectly reasonable to us to impose certain restrictions, these on the other hand might be obnoxious or even intolerable to other nations; and in that event they could be carried out only by force. As the canal will lie in foreign territory inaccessible to our army, its defence or control must fall on the navy. It thus becomes another dependency, communications with which must be kept open on two oceans. But these oceans afford ready access to the canal for any power having a naval force, and our control is possible, therefore, only by predominant naval strength, both in the Atlantic and Pacific. This is certainly a very large contract for

us to assume "in addition to our other duties," yet current discussion about our control of the canal runs on as flippantly as though it was to connect the Chesapeake with the Delaware.

We have not yet reached the point of making our foreign trade a national interest. We see other powers intriguing and striving to extend their commerce by all methods, and watch their jealousies and struggles comparatively unmoved. Our trade with North China was larger than that of any other nation, and is threatened with absolute extinction, but it arouses no popular feeling. There is no insistent demand on the part of the nation at large that the Government should take any decisive action in China in protection of our commerce. And yet with this comparative indifference to foreign trade is coupled the fact that in the last fiscal year our export trade was larger than that of any other nation. This commerce has not grown up, however, through any concerted effort either on the part of our Government or of our manufacturers. Like our national expansion, it has come in spite of ourselves. Our manufacturers still look mainly to the home market, and the popular idea of foreign trade is that of selling products for cash rather than of exchanging goods. Reciprocity treaties are at present having a hard time of it, and no legislation is ever obtained directly in favor of our foreign commerce. It is inconceivable, however, that this will continue. Our capacity for manufactures is so greatly in excess of any possible home consumption that we must look more and more to opening up markets abroad. The advances we have made in the last few years show what we may expect when our people really make a *business* of foreign trade. We shall then find that we are in the thick of the international complications resulting from the struggle for trade, and although we may never go so far as to seize territory in order to monopolize its trade, we are just as likely to get into trouble by advocating the "open door." With the exception of Great Britain, the efforts of European powers are now more generally in the line of obtaining special commercial concessions, and the open door policy is unpopular with all monopolists.

Copying again from the *Spectator*, we find an interesting review of the question of international trade complications, with their possible consequences in the issue of April 20, 1901. The following is an extract:

The annoyance of the Continent with America, which is very deep, is based upon three reasons. There is first of all, a dread, or rather a conviction, that competition in business with America is nearly impossible. Her wealth and energy are too great, and both are employed, as Continentals think, to monopolize trade, and so control in the end all the wealth of the world, an idea not without advocates even among ourselves. These giant trusts are regarded as enemies, inexpressibly formidable because they do not raise prices, which would to traders be some compensation, but look to monopoly of business as their reward, and because, if the governments fence them off with tariffs, the Americans, being Protectionists, do not scruple to commence quick and severe reprisals. As the governments are always trembling with nervousness lest their industrials, if driven out of work, should turn to Socialism as a refuge, this cause alone inspires them with a permanent suspicion and dislike of American action. Then they see, as yet dimly, but still without doubt, that America will interfere grievously with their plans for securing new and permanent markets. America does not interfere in Africa because Africa is negro; but the hopes of Continental Chancellors of the Exchequer turn to Asia, and in Asia it is clear that America will be sadly in their way. The whole action of Washington in this Chinese muddle points to a single conclusion, that although Americans took the Philippines, they are unwilling to see any but native powers in possession or control of the richer countries of Asia. They do not much mind England, because she admits all the world to share her commerce, or Russia, because they regard Manchuria as a mere railway route, but they are utterly opposed to a partition of China, or a subjugation of Japan, or any other great change which would place their manufactures at a disadvantage. That opposition is most irritating to men who sincerely believe that open trade is of no use to them because America and England are sure to get it, and who look therefore to conquest in one form or another as the only permanent protection for their industry. The bitterness is all the deeper because it is, in a sense, philanthropic, those who feel it honestly pitying their own people, because they cannot, in the fierce competition which prevails, get enough work to do. And lastly, every State on the Continent feels keenly the dog-in-the-manger attitude of America about the future of South America. She will neither take it nor let anybody else. There lies the vast continent with scarcely anybody in it, with climates, which, though varied, do not prohibit European labor, with sources of wealth in the soil that are practically limitless, and with vast rivers which render entrance into the far interior at once cheap and easy. There is no prize left in this rapidly dwindling little planet like South America. Germany would like the whole of Brazil, in which she is already strong; Italy even now sends her children by the hundred thousand to Argentina; France would feel richer if she could acquire the Hinterland of Guiana; and even Hungary would much rather that her Slav children, who in tens of thousands are doing the hard work of North America, should find acceptable homes under their own flag in Uruguay. All are warned off by the Union in a way which, as she will

not annex, or even allow herself to be responsible for these territories, seems to the statesmen of the Continent the very height of selfish impertinence. Why, they think, should their children be shut by a pure caprice from natural and profitable careers? The total result of these feelings, is a bitter dislike of America, mixed with a certain dread that produces the sense expressed alike by Count Goluchowski and Count Canevaro, and not obscurely hinted at by Count von Bülow, that a league of Europe against America will ultimately prove to be "a necessity of civilization."

Our friends in America, who are incurably optimist, believing that whatever happens all will go well with them, will not credit our description of the situation, or will even imagine that we are only pleading for the Anglo-Saxon alliance which we have so often predicted for the future. They are in error. We have not stated the case against the Continent—and especially in regard to Germany's aspirations and aims—half as strongly as we believe it ought to be stated, and we are entirely at ease about the Anglo-Saxon alliance. That is safe enough in the fulness of time without any help from publicists. Our object is only to waken Americans from an illusion, to induce them to increase their fleet steadily instead of by rushes, and to persuade them, if we can, to think out what they are doing, and not act, as we too often do, upon the spur of the moment. They may rely on it that the Continent will lose nothing for want of planning, and that when the alliance against America of which Count Canevaro talks is transmuted from a hope into a fact, the fact will be full-grown and armed.

These comments of the *Spectator* are certainly most interesting.

The trade of the future, or at least the trade that is to be developed, will be mainly on the Pacific. Its shores are bordered by nations containing half the population of the world. As yet, these masses are dealing with each other indirectly, China trading, for example, with New York and London rather than with San Francisco, but the next few years will see direct routes established that will make the Pacific the ocean of the world. We are involved in this future development from our position, whether we wish it or not. Back of San Francisco, Seattle and other cities of our Pacific coast, lie the industries, resources and commercial vigor of our nation, and all will come into play as soon as it is evident that there is a new field for them in Asia. We are not seeking this, but it will inevitably come. The future may thus see struggles for trade supremacy in the Pacific, which will be all the sharper and more bitter from the fact that there is so much to be obtained by the first comer or the most unscrupulous.

After this casual examination of the field it is needless for us to select any nation as our special antagonist. We are liable to

have trouble from one reason or another with almost any of the powers and must consider war as a possible result. Personally, I believe that we have fought our last war with Great Britain. The numerous questions arising in the future will be settled as their predecessors have been for the last eighty years, by diplomacy and not by arms. If this is admitted, it frees us from the necessity of considering the British Navy in our plans, and materially simplifies matters.

As we analyze the work thus outlined for our navy, we find it almost entirely of a military character. Even maintaining communications with outlying possessions is not a mere matter of policing the sea, but rather involves the destruction or capture of any force by which they are threatened, and this demands two essentials in our ships—speed and fighting strength. Neither can be sacrificed. Without speed and coal endurance we could never catch our enemy; without fighting strength we could do nothing with him when caught. If we had any commerce to protect; if our trade routes were covered with American ships that might provoke attack, we would need fast, light armored ships to overhaul and destroy possible assailants. As this commerce is, however, almost non-existent, it is unwise for us to design special ships for its protection. Even if we were at war with Great Britain it would be unwise to spend money for commerce-destroyers, as they would not earn their cost. Only one thing can break up commerce, which, like that of England, is vital to her very existence, and that is blockade. Privateering, raids, or operations or so-called commerce-destroyers are mere incidents of war, affecting, perhaps, freights and insurance, but not in any way crippling or causing serious distress. Any power or combination of powers that seeks to apply the sovereign remedy of blockade to the British Isles must reckon with the British Navy.

The measure of success we may attain in a foreign war depends, therefore, purely and simply on naval strength, and this means not numerical but fighting strength. Whatever enemies we may meet can be overcome by force alone, and this must be of a kind which will be effective in a modern naval battle. Strategy and tactics are sometimes supposed to atone for want of fighting strength, and so they do to the extent of utilizing to the utmost what strength exists. Napoleon and Nelson, the

personification of military and naval science respectively, unite in demanding strength. "Providence is on the side of the stronger battalions," is just as true that "only numbers annihilate." If, therefore, we are to build our navy on true principles, are not the fundamental ideas, first, to have plenty of units, as many as possible, and second, to have every unit endowed with fighting strength. We should allow nothing to lead us away from the cardinal idea that the navy is for battle, as in battle only can the issues of war be determined.

In battleship construction we are well to the fore. We have to a certain extent been trying to please every one, our seventeen battleships, built or under construction, representing six different types. These are supposed to show a gradual improvement in design, but this has been questioned. As was very aptly said in the discussion of Mr. Taylor's article printed in the last number of the PROCEEDINGS OF THE NAVAL INSTITUTE, we seem to have abandoned the plan of building *better* battleships than other nations do, and to have substituted therefor the policy of building *as good* as any. Our first four battleships carried eight 8-inch guns, and were most unfavorably criticised by foreign critics as being "over-gunned." An undue tenderness for the opinions of others must have been operative in the abolition of the eight-inch battery in the Alabama and Ohio classes, and the substitution therefor of fourteen and sixteen 6-inch guns respectively. We copied foreign construction, and as a result have ships *as good* as any of their type anywhere. In the latest ships we have once more adopted the favorite eight-inch gun, and if we can get rid of the six-inch, replacing them by an equivalent weight of extra eight-inch, would again be building *better* fighting ships than our rivals. To face the point squarely, what is the reason for installing a six-inch gun in new battleships? Such a ship is designed to give and take hard blows, but the six-inch is not an armor-piercer, and is useless against the Krupp armor of recent ships at ordinary battle ranges. It is not a sound argument to say that the new gun is capable of injuring existing foreign ships, although this fact may be enough to justify its retention in ships already finished. The Virginia finds her contemporaries, however, under construction, and they, with their Krupp armor, are practically invulnerable against the six-inch. Why then install it? An opinion seems to exist in some quarters that a dozen

small guns can get their projectiles through armor that no one can pierce singly, but this is pure hypothesis if not humbug. The common-sense solution is to install guns that can put every shot through their opponent's medium armor, and the new eight-inch gun fills the requirements.

The question of battleship speed is the most difficult one to settle in connection with the type. It is hardly right to decry speed as enabling a fleet to run away but not fight. It will enable it to overhaul a slower fleet and bring it to action, and it unquestionably has a distinct tactical value in a fleet action. The old manœuvres of concentration as practiced at the Nile and Trafalgar are now impossible, when every unit of a fleet is highly mobile, and any threatened point of the fleet formation may be quickly reinforced. The principle of concentration remains, however, as true as before, and any fleet that can maintain its force in concentration against an enemy's flank or rear in action for five minutes will gain an advantage that may ensure final victory. This advantageous position may be gained by the bad manœuvring of the enemy, but if he is alert, can be ensured only by superior mobility. Speed is, however, only one factor of mobility, the other, frequently overlooked, but equally important, being handiness. A fleet of fast battleships, the speed being gained by increased length, cannot out-manœuvre slower ships with smaller turning circles. If this is true, we certainly want no 21-knot battleships, and may well ponder whether the gain of speed in the Virginia by the increase of under-water length is an advantage. An eighteen- or even a seventeen-knot "turn-about" is unquestionably a better tactical unit than a clumsy nineteen-knot ship. It must never be forgotten that the normal sphere of the battleship is in fleet formation and not on detached service, and that a fleet's manœuvring ability is measured by that of the slowest or clumsiest ship.

One of the most original of recent battleship designs is found in the Vittorio Emanuele III," of 12,625 tons, of the Italian Navy. This is on the principle of high speed at expense of fighting efficiency, but once more illustrates the ability of the Italian constructors in designing efficient compromises, the speed having been gained on moderate displacement without undue sacrifice of fighting power. The battery is to consist of two 12-inch and twelve 8-inch. These ships certainly have good fighting ability,

and by abandoning the 6-inch gun for the 8-inch, provide for effective fire against the most recent ships.

The most interesting feature of the Italian design is found in the fact that this fighting battleship has a cruiser's speed, 22 knots, and can apparently overhaul almost anything afloat, while at the same time capable of defeating almost everything, battleships excepted, that it can bring beneath its guns. No protected cruiser or gunboat, and but few armored cruisers, would have much chance of escape if once sighted by a ship of this class. If this type is successfully developed its influence on naval construction will be very marked. All large ships must be given guns, speed and armor to ensure their having a chance of life against it.

The new ships, by means of a most remarkable under-water body, aim to attain high speed while retaining excellent turning power. They are certainly a most fascinating combination and afford plenty of thought to students of battleship construction. A squadron of this type could choose its own time for battle, and if well directed would derive great advantage in action from its speed. Neither speed nor tactical ability could, however, when battle was once joined, overcome heavier guns or better armor, if equally well handled, and in battle only is the real test of battleship construction.

The armored cruiser has always furnished a fine theme for argument. If, however, the idea already presented—that the prime necessity of our navy is for fighting ships—is acknowledged as correct, it limits the field within which our designers must work. No armored cruiser can, of course, have the high speed necessary for cruising purposes, and also sufficient fighting strength to successfully engage a contemporary battleship, single-handed. It should, however, be strong enough to face any vessel of her class in a duel, or to mix in a general action, with and against battleships, under which circumstances individual contests between ships are extremely improbable. The requirements for a ship fit for the above purposes, *i. e.*, general cruising and also fighting in line-of-battle, may be summarized as follows: Speed, 22 knots; length about 400 feet with under-water body cut away so as to promote handiness and turning power; battery to contain at least eight or ten 8-inch guns of latest type, with a large number of 14-pdrs. for use against small vessels; armor, a complete belt of not less than four-inch Krupp armor to keep

out high explosives and protect the cellulose against small R. F. projectiles, and not less than six inches of armor over every gun of main battery. This combination is by no means impossible, and can probably be realized on a ship of about 10,000 tons without sacrificing the coal endurance necessary for efficiency.

The latest type of eight-inch gun may be classed as a rapid-fire armor-piercer, and is effective against the casemates or water-line of the very latest foreign battleships at 3000 yards. With six of these guns on a broadside the cruiser could certainly give a good account of itself, and as nearly all foreign ships have no calibre intermediate between six inches and the large guns in the main turrets, if our cruiser has sufficient armor protection to resist a six-inch shell, it can be injured only by the main battery of its opponent. It is, therefore, effective in drawing the enemy's fire, as well as in directly injuring him. It is noticeable, moreover, that the 8-inch gun can penetrate the turret armor of many late battleships at 2000 yards. A ship of this kind is a "battle-cruiser," not merely an armored cruiser. The latter term may mean anything; the former conveys the idea of a cruiser fit for battle, implying both guns and armor. This type is a fighting vessel and, therefore, in accordance with our necessities. At the same time the ship is as effective for chase, for blockade, for overhauling and capturing protected cruisers as any light armored cruiser could be. Phenomenal speed may well be sacrificed. Twenty-two knots is very high and, probably, all that will be needed ninety-nine cases out of a hundred. It is unwise for us to design for the hundredth chance, when the resulting ship will be unfit for battle.

The two armored cruisers we possessed in the Spanish war proved to be very serviceable. They are, however, too lightly armed to be duplicated and are also lacking in protection for personnel, which all recent experience shows to be most essential. They were not fitted for service in the line-of-battle when they were built, and are still less adapted for the work of a battle-cruiser to-day. The new cruisers of the Maryland class have been fully discussed recently in these pages and call for apparently but little commendation from the men who must use them. They are defective in that they do not have fighting strength commensurate with their cost, and are not adapted to any of the demands liable to be made on our navy. Their guns are too

small to injure a fighting enemy of smaller size; their armor is inadequate to protect the personnel against his fire. Their high speed is secured by increasing the length to such an extent as to cut down manœuvring power and render it impossible for them to act in company with battleships. Their speed will enable them to overhaul an enemy, but their low fighting power may render this a risky operation. There are very few docks which they can enter, and their operations, whatever they may be, are therefore limited in location. While fulfilling none of our requirements, they cost over four million dollars each and demand the service of a crew of over eight hundred men apiece. Have we either money or men enough to afford six such costly luxuries?

Fortunately, Naval Constructor Taylor's recent article directed the attention of the service to these vessels before they were really laid down, and there is plenty of time in which to change their guns and armor and vastly increase their fighting ability without interfering with their one good quality of speed. Such a change would render them of some practical service to the country, and it is wiser to face the problem now than invite disaster in the future. The country at large will consider these vessels as fighting ships, and will bitterly resent either their capture in war by a smaller but better designed enemy, or their obtaining safety by flight.

The St. Louis type is still more inferior. Her four-inch armor is penetrable by the six-inch gun at 4000 yards, while her six-inch guns are useless against the six-inch armor now so prevalent in foreign navies. There are many vessels of equal or even smaller size that could receive her fire almost unharmed, while their own guns could readily pierce her armor. In a battle of this kind the St. Louis would stand almost as good a chance of winning if she were armed with smooth-bores. The St. Louis is nominally a protected cruiser, and the money allowed is probably insufficient to give her the armor she needs, although she could be given heavier guns.

If we review our naval history since the Revolutionary War, and analyze the cause of the large measure of success we have attained in battle, I think any unprejudiced student will attribute it in great degree to the fact that we have made it a rule to have heavier guns in better ships than our opponents could bring

against us. We carried out this idea in the Minnesota class, the most powerful ships afloat in their day. Our first steel cruisers and battleships conformed to the same rule. If there is one principle that we have consistently clung to throughout the life of our navy, it is that of giving our ships the maximum of gun power. Even now, the acts of Congress authorizing construction of armored vessels always demand the "heaviest guns," or "most powerful ordnance" of the class of ship. Have our old traditions proved false that we are now violating them?

While advocating heavy guns, we must not too fully rely on the theory that a ship's best defence is in its battery fire. So it is within limits. If we believed it absolutely we would not build armored vessels. Santiago and Manila both showed the necessity of protecting the personnel. No amount of personal courage will enable a man to stop a six-inch shell with impunity, and no battery fire, however rapid and accurate, will avail for defence if the projectiles fired are too light to pierce our enemy's armor. The United States ought not to be called upon to pay three million dollars for any ship that cannot face a foreign ship of equal size and cost without a good chance of beating her. Given good fighting ships, it becomes the duty of the naval officer to get the maximum work out of them by training and discipline of personnel, but no effort can get fighting strength out of a ship unless it has been built into her.

If the general proposition be once admitted that all armored ships built for our navy should be designed for fighting in squadron, there still remains the question of the relative number of battleships and battle-cruisers. If fighting power is the prime requisite, why construct anything but battleships? The answer to this question involves the very existence of the armored cruiser. The type is in existence in all prominent navies of the world to meet the demands for work for which the heavy and slow battleship is but poorly adapted. Among these duties is scouting, chasing an enemy's scouts or cruisers, following and harassing a retreating armored fleet, detaining an unwilling enemy and bringing him to battle, chasing enemy's armored vessels attempting to break blockade. If these duties are to be performed against opposition, armor and guns are as necessary as speed. The Italians are attempting to build one type, which will efficiently perform these duties and also have full fighting

efficiency, but in all other navies there are two classes. This separation enables the fighting ship, par excellence, to receive the maximum armor and ordnance with moderate speed, while the cruiser should be given as high speed as is compatible with enough gun power and protection to enable it to be classed as an effective fighting unit. If any type is threatened with extinction it is not the armored, but the protected cruiser.

The answer to the above question cannot be given off-hand. Probably all officers would agree that we need more battleships than battle-cruisers. However useful the latter may be, they cannot rank in actual warfare higher than battleships second class, and there must be enough battleships built to meet our requirements for a powerful navy. While battle-cruisers may assist in a line-of-battle in a most material way, they can never take the place of the slower and heavier battleship. They are additional to it, not in any degree replacing it. In view of the fact that we are at present spending millions on armored cruisers of low fighting power, it seems that our immediate necessities are for ships that can fight, and what money may be voted for the next few years should go mainly for battleships. Three of the latter to one battle-cruiser might be a fair ratio for the present.

It is unnecessary to make any reference to monitors, as since the Spanish war naval opinion has crystallized against them. Of undoubted utility in harbor defence, their worthlessness at sea renders them a care and incubus in a fleet, and the best use to be made of them is to send them into port. Still, we can probably find use for those we have, and may even build others, but public opinion should never be allowed to consider them as increasing the fighting efficiency of the Navy. They are more nearly allied, so far as their usefulness is concerned, to permanent fortifications than to battleships, and while making excellent harbor guards, have practically no offensive power that can be brought to bear against an enemy at sea.

In omitting any consideration of the building of other ships for our navy than armor-clads, it is, of course, simply because it is outside the limitations imposed by our subject. A well-digested solution of a general ship-building scheme appeared in the last number of the PROCEEDINGS OF THE NAVAL INSTITUTE. Mistakes are less liable to be made in building small ships than in armored vessels, but the latter are so much more important,

more costly, and require so much more time for their construction that we can ill afford to make errors of any kind in connection with them. For this reason, this article is intended only to call attention to what seems to be the most vital point of our policy of construction.

As the final feature in the examination of our naval necessities is the very important question of how large naval forces we may be called on to confront. The general comprehension of the value of sea power, and the illustrations conveyed by the Spanish war of 1898 have led to a great activity in all the shipyards of Europe. Comparatively little attention has been bestowed on matters of military increase, while there has been a general building up of naval strength. It is a matter of comparative indifference to us how large European armies may become, as they cannot act against us, but we cannot remain indifferent to increase of naval force, as that may not only affect our interests unfavorably in many quarters of the globe, but may cause national disaster by defeating our fleet in war, and render possible blockade of our coasts or even invasion of our territory. We must, therefore, study the growth of all foreign navies to keep up a certain relative strength. This may lead to a competition in shipbuilding, but our resources fit us to enter upon this with equanimity, especially as under the law all money for shipbuilding is expended in our own territory, and the building of battleships stimulates many branches of trade and gives employment to thousands of men. The manning of a large fleet is another matter. Experience goes to show that we can obtain all the recruits we need, although at a much greater expense than would have to be incurred by any other country. This condition we must face and accept.

The direct comparison of the fighting strength of different navies is a matter of great difficulty on account of the widely different types of ships between which comparison is impossible. Some ships almost defy classification. The following table is probably approximately correct at least. (See next page.)

Several nations have adopted definite programs for naval increase, while others, like ourselves, vote new ships from time to time. Great Britain, which builds more than any other nation, is apparently still acting on the policy advanced long ago of maintaining her fleet at a strength equal to that of any two other

nations, and now has an exceptionally large number of ships under construction. This policy will probably be adhered to, and while it is therefore impossible to predict the size of the navy at any future time, it is safe to calculate on its always being greatly in excess of any other.

	England.			France.			Russia.			Germany.			U. S.			Italy.			Japan.		
	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.	Built.	Building.	Total.
Battleships, 1st Class	24	17	41	10	3	13	6	8	14	6	10	16	9	8	17	3	6	9	5	2	7
" 2d "	11	..	11	9	1	10	10	1	11	..	..	..	..	..	..	5	..	5	..	..	..
" 3d "	10	..	10	11	..	11	1	..	1	5	..	5	1	..	1	2	..	2	1	..	1
Total Battleships	45	17	62	30	4	34	17	9	26	11	10	21	10	8	18	10	6	16	6	2	8
Coast Defence Ships	9	..	9	8	..	8	3	1	4	8	..	8	6	4	10	3	..	3	1	..	1
Harbor " "	9	..	9	8	..	8	12	..	12	11	..	11	..	..	..	..	..	..	..	..	..
Armored Cruisers	12	22	37	10	14	24	11	1	12	4	3	7	2	6	8	4	1	5	6	3	9
Total Armored Vessels	75	39	114	56	18	74	43	11	54	34	13	47	18	18	36	17	7	24	13	5	18

The most comprehensive building program is that of Germany. It is advanced as a well-digested scheme of proportioning naval expenditure to national wealth, and although this involves considerable speculation and counting of chickens before they are hatched, there is but little doubt that the plan of construction will be carried on, whether taxation is increased or not, as the scheme of a large navy has been made popular throughout the country, and any extra burden involved will be cheerfully borne. We can therefore count with comparative certainty on the *minimum* strength of the German Navy for many years to come.

It is unnecessary to dwell at length on the plan of construction as it has been published to the world. A digest may, however, be of interest. (See next page.)

An inspection of this table shows that in the next four years (1902-1905), Germany will lay down eight new battleships, which, with the eleven now finished and the ten under construction, will give her a total in 1908 of 29 completed battleships, all but five of which are of steel. In addition to these, there are eight coast-defence vessels which are being reconstructed to fit them for general service at sea, making a total of 32 modern steel ships, and five additional ones of iron. This is practically the full

numerical strength of the proposed new fleet which is to include 38 battleships, and it is attained in 1908, instead of 1920, as the scheme pretends. In the next three years (1906-1908) four more battleships are built to replace an equal number of the iron vessels now in service. In 1909 there is one more new construction, bringing the total up to the figure of 38. The next six years see 13 new battleships built to replace old constructions, but some of the ships replaced are contemporary with the Oregon in our navy, and others are improved coast-defence vessels, and although obsolete in the eye of the law, will undoubtedly be serviceable in some way.

	Battleships. 1st class.	3d class.	Coast Defence.	Large Cruisers.
Finished Fleet, 1901.....	6	5	8	4
Under construction, 1901.....10				3
To be laid down, 1902.....	2*			1†
1903.....	2*			1†
1904.....	2*			1†
1905.....	2*			1*
1906.....	2†			1*
1907.....	1†			2*
1908.....	1†			2*
1909.....	1*			1*
1910.....	1†			2†
1911.....	2†			1†
1912.....	2†			1†
1913.....	2†			1†
1914.....	2†			1†
1915.....	2†			1†
1916.....	2†			

* New ships in addition to present fleet.
† New ships to replace others legally obsolete.

The increase in armored cruisers is uncertain. The law calls for "large cruisers," and these may be armored or not as circumstances demand. Thus far good fighting ships, battle-cruisers, have been laid down. A point of interest is that during the years above noted (1901-1906), in which the greatest addition of fighting strength is made by the construction of new battleships, only one large cruiser is laid down each year, but when the battleship total is reached, two large cruisers are built annually. The first aim of the whole scheme is to get the fighting ships in service as soon as possible. After that old vessels can be replaced, the legally obsolete vessels being frequently serviceable. It is interesting to see on the list of vessels replaced in 1915 and 1916 the Furst Bismarck, Victoria Louise, Freya and Hansa, which have just been finished, and will undoubtedly be fairly efficient ships at the above dates.

The German scheme is an admirable one, and will give the nation a fleet which at all times will be in excess of the nominal figures. Unless Germany is to attain a predominant strength on the ocean, other nations, ourselves included, must build steadily. An average increase of two battleships and one battle-cruiser to our navy annually will preserve our relative standing; while two battleships and two battle-cruisers, or three battleships and one cruiser, laid down each year will keep us ahead in fighting strength. If we do not build we must, of course, accept any consequences that our naval inferiority may bring upon us.

The French have had one or two programs. The one now in force is designed to give France in 1907 a force of 28 modern battleships and 24 armored cruisers. This scheme does not involve a very large amount of construction. In 1901 the estimates are for two battleships and one armored cruiser. The French seem to be greatly enamored with the submarine boat and are laying down a large number.

Italy has evolved a plan extending up to 1910 for new construction. This provides for ten new battleships of about 10,000 tons each, besides the reconstruction of the Italia and the Lepanto. It is doubtful if this plan will be carried out. The latest ships designed are of 12,600 tons. The finances of Italy are not in such a condition as to warrant a very long look ahead in designing a plan for naval increase.

Japan has practically completed her building program of 1895 so far as large vessels are concerned. One new battleship and two armored cruisers are said to be projected.

Russia's program of 1898 provided for the building of eight battleships and eight "large" cruisers by 1904. Some of the latter were unarmored.

The following résumé shows the probable number of modern armored ships, excluding harbor-defence vessels, ready for service in 1905:

	United States.	Great Britain.	Germany.	Russia.	France.	Italy.	Japan.
Battleships, 1st class....	17	44	16	14	13	9	7
" 2d class	..	11	..	11	10	5	..
" 3d class	1	10	5	1	11	3	1
Total Battleships	18	65	21	26	34	16	8
Coast Defence Vessels ..	10	9	8	4	8	3	1
Armored Cruisers.....	8	40	8	16	24	5	9
Total Armored Vessels ..	36	114	37	46	66	24	18

Here our program ends, while that of other nations continues. Our Navy will probably be strong enough in 1905 to enable the foreign policy of our Government to be carried into effect, but not in 1908 unless further increased. It seems as though the country was confronted with the choice of two alternatives. One is to give up the Monroe doctrine and all plans for controlling an inter-oceanic canal, the other to increase our armored fleet at a minimum rate of four vessels annually, with proportional increase of personnel. If the second alternative is chosen, the contention held throughout this article, that all armored vessels built by the United States should be designed for place in the line-of-battle, is once more reiterated.

WASHINGTON, D. C., April 11, 1901.

Sir:—The Bureau transmits herewith a copy of a letter from Captain F. E. Chadwick, relating to the training of seamen. Captain Chadwick has consented to the publication of this letter in the NAVAL INSTITUTE, and the Bureau would be pleased to have it so published, and to have the INSTITUTE invite discussion of the same.

Very respectfully,

A. S. CROWNINSHIELD,
Chief of Bureau.

Secretary,
Naval Institute,
Annapolis, Md.

NAVAL WAR COLLEGE.

NEWPORT, R. I., March 29, 1901.

Sir:—I beg to be allowed to offer some views upon the methods of training seamen. My excuse for so doing, unsolicited, is due to my interest (which dates many years back) in the Training Service, with the inception of which and with the establishment of the Coaster's Harbor Island Station, I hope I may say without impropriety, I was somewhat closely connected; and in the great results of which, and its final establishment on a secure and (in my view) a proper basis, I have, as has every officer, a natural service pride.

2. While we have finally arrived at the great desideratum of beginning the training of boys in barracks, there is still involved in more or less discussion the method which should be adopted as to the early training afloat; whether this should be done in steamers or in sailing vessels. This question is unsettled in the

minds of many not only in our own service, but in the English, where of late it has been agitated in a very animated manner.

3. The subject goes to the root of the meaning of education, but is one which seems to me less difficult of solution in the case of boys trained for the navy than in the case of those who are educated ashore without particular aim as to their later life. In both cases education should, first of all, mean development in character; and acquirement of information be regarded as secondary. It is hardly to be gainsaid (though the fact is so largely lost sight of in our general educational systems) that character is pre-eminently what society regards as desirable to develop in youth. Granting this to be so in general, it applies with much greater force to the boy who is to serve at sea; who is not only to deal with the forces of nature in their elemental shape to a greater degree than the man following any other calling, but whose whole training looks to possible battle. It thus becomes a primal need to call out the more manly qualities as differentiated from those which tend to make him studious and bookish. He may have both; so much the better; but the first-named qualities of courage, resourcefulness, activity, strength, all those, in a word, which tend to make the naval seaman pre-eminently the "handy man," as he has been lately termed, must be first, and I have become convinced, most thoroughly convinced, that these qualities are acquired far better in a sailing ship than under any other circumstances. I thus think that the training of our boys after leaving the Training Station and before their transfer to the general service, should be in ships fitted with sails only, and with no steam-power whatever.

4. There does not exist in any life in the world, unless it may be in that of the Alpine guide, a school for the qualities mentioned, approaching in value the sailing ship. No boy, no man, can be in the habit of furling a topgallant sail on a breezy day, or of reefing sails in a gale, without acquiring certain qualities of the highest order, such as those mentioned. A lifetime's cruising in the steamer without sail will not give him such. And these qualities would be stamped on him in the sailing ship at his most impressionable age and during a period when the "information" part of education might well be allowed to lie dormant if necessary. But the fact is that a large part of the information he needs he can gather in the sailing ship as well as in an armored

cruiser. Most of his gun-drill would be the same; his small arm, his setting-up drills, the general work and life of the ship would be the same, and he still has years to learn the details of the battleship; details which he will absorb in a few months' time, consciously and unconsciously. He grows into this knowledge as much as by being trained to it, so that I do not believe at all in the necessity of his time being spent in the first part of his career in making him acquainted with details which will come later in a perfectly natural way or by the still later training of the seaman gunner and electrician. We want first and above all, the manly, courageous, handy and active man, and this being granted, I believe the natural corollary is that our training squadron should be one of sail only, with no steam and with no adjuncts which would bring the young sailor man less face to face with his great teacher—the Sea.

Very respectfully,

F. E. CHADWICK,

Captain, U. S. Navy.

THE SECRETARY OF THE NAVY.

DISCUSSION.

Captain CHARLES D. SIGSBEE, U. S. N.—Following the lead of the author of this letter, perhaps I may be permitted to present my warrant for an earnest interest in the matter under discussion. I have sailed on board eight sailing ships, seven square-rigged steamers and four steamers depending on steam alone. Of these vessels I have commanded four sailing ships and five steamers. My sailing commands were practice ships of the Naval Academy and one training ship for naval apprentices. I also was head of the Department of Seamanship at the Naval Academy for four years. Therefore, my field of observation has been rather broad and my experience of a kind to give me more than usual reason for cherishing a sentiment in favor of sail. I have that sentiment in large degree, but not as applied to the present needs of the service, for sail is dead in the naval service—dead beyond resurrection. For training purposes no more is claimed for sail, even by its most insistent advocates, than that it is the kind of gymnastics best suited to the Navy.

The majority of officers who advocate the use of sail for the training service admit that they desire to get the same kind of alert, handy and active men that we formerly had for topmen. In the days of sail it was held that it took longer to teach a man the trade of seamanship than any other trade whatever. If a man was made a thorough seaman and

topman in three years from the time of entering the service, he was an uncommonly adaptable man. The topman of the old days was a mature product, the result of years of training; he was an adult. Our present system is to train our naval apprentices for six months on shore and then add six months at sea. During the latter period sail exercise is the leading feature. He is then sent on board a mastless ship where all sail exercise must necessarily cease. He is not a finished seaman, nor has he become ingrained with the habit of the sea, which is a quality much dwelt on. He is only a lad. We do not now get the old-fashioned sailor by means of sail in the training service, nor can we get him without expending an amount of time on his training that cannot be spared. The desideratum at present is to train more rather than fewer apprentices. With the same facilities we can train twice as many apprentices by making the course one year as by making it two years.

I have heard officers assert that "the best place to make a sailor is on board a sailing ship"; that is a phrase and not an argument. Its value depends on the kind of sailor we want. If we want a sailor, or to use a better term, a "seaman," who is seven-tenths soldier and mechanic, then the best place to make him is not on board a sailing ship. The kind of man that we should desire in the naval service is precisely the kind of man that we need to carry on the duties as they exist at the present day. It would not be thought necessary on shore in hay-making to keep a man at the old-fashioned scythe for six months in order to educate him up to a seat on the mowing machine.

Sail exercise carries with it much of the "helter-skelter" and "bully boy" spirit of the old days. It makes a *horny-handed, stiff-fingered* man instead of a *soft-handed, limber-fingered* one, and the latter is what we now need. It was a sight in the old sailing days to see a topman write a letter. He was a fine fellow for his period, but he handled the pen with about as much dexterity as could be expected from a parrot or an eagle.

Sail seamanship involves the use of about the clumsiest and most hand-hardening mechanisms to be found anywhere, whereas the modern mechanical details of shipboard in the Navy are, as a rule, exceedingly delicate in comparison. The kind of nerve and action needed at the present day differ widely from the reckless kind needed in the days of sail. If the use of sail for training purposes were to lapse for a year or two nobody would dream of going back to it. I am inclined to believe that much of the objection to the abandonment of sail exercise comes from a vague fear that something valuable will "go by the run," without adequate substitute if we relinquish it. If we were to abandon sail exercise we would thereby gain much time which might be devoted in large part to that kind of instruction which is now given at the Torpedo School, Gunnery School and Gun Captain School.

While in command of the training ship Portsmouth I always felt, when inspecting a new draft of apprentices, that I could point out initially a large number who would not remain in the service. Many came because of romantic ideas of the sea and sailing ships. Others came because

their parents desired them to escape rather undesirable associations, and these lads were willing to enter the training service because of the same romance of the sailing ship. Such lads conceived that sail exercise was the dominant thing on board the training ship. They were always better at that exercise than at anything else. All drills with arms were discounted. A number deserted and comparatively few remained in the service after sea experience had stripped their conceptions of romance. An officer once said to me in those days, "The training service acts as a decoy for boys. When they find out that they are decoyed they leave." If sail drills were abandoned and modern drills substituted therefor, the preconceived notions of young apprentices would meet with much less violence. The setting-up drill as taught at the Training Station is better as an exercise in producing a well-balanced physique and serving for modern purposes than sail exercise; very much better; but unfortunately it is not taught nearly so well in the general service as at the Training Station. There is no other drill known to me so well calculated to produce good concerted action and to enchain the attention of considerable bodies of men to the drill-master. It has had more to do, in the service at large, with making petty officers drill-masters than all other causes combined. That exercise, if properly conducted, together with the routine duties of shipboard and with boat exercise in larger degree than at present, would suffice to keep our crews in good muscular form. Pulling exercise in boats is sadly neglected in the service, through the habit of using steam launches. During the last fifteen years of observation I have rarely seen a single-banked boat of the United States Navy under way in which some of the crew were not pulling breast-stroke and others side-stroke. I have called attention to it very many times and have tried to correct it in my own commands. I should like to digress enough to say that side-stroke is a fancy stroke which has no place in the service in this day of prompt utilities.

I desire to refer to another point, although it is only indirectly connected with the letter under discussion. The question has often been brought up as to whether a naval apprentice should have a considerable period of instruction on shore before going on shipboard, or should be embarked at the outset, or after a very short period on shore. I have held in the progress of conversational discussion that all arts are kindred as to methods of instruction. The art of the man-of-war's man should be no exception. In every other art the person under instruction begins with the easiest or most elementary principles, under the easiest or most favorable conditions, and advances step by step toward the greater difficulties and the higher practice. A lad suddenly thrust into man-of-war life, without previous training, is confronted with sanitary conditions of which he is ignorant, with a complex terminology, routine and construction, and also a multitude of duties and an all-pervading and rigid discipline. He flounders, drifts with the tide, and becomes careless and discouraged. In my opinion shore practice should be given until nothing is left to be learned by an apprentice except those things whereof the ship must essentially differ from the Training Station. The weeding-

out process should take place on shore to the fullest practicable extent. One would not begin to train a newly formed regiment of volunteers in the mud, or suddenly subject the recruits to regimental manœuvres. On the contrary the men are divided into small squads, which are put under instruction conjointly in charge of non-commissioned officers. Each man therefore receives more individual attention and his personal qualities are better known. Herein we have analogy with instruction in other arts. In the Navy we have always drilled men in too large bodies at the outset.

If there are any advantages of sail in the training service they apply also with some force to the Naval Academy; therefore, I may be permitted, perhaps, a slight extension of view in the direction of the Naval Academy. I believe that the continued use of training with sail is not only of doubtful benefit to the service, but that it is very harmful. I have held this view for many years. As against all former argument we find the steamer now forcing its way into the training service and into the Naval Academy through the mere pressure of logic. The retention of sail has hurt the Navy in Congress. Although officers, for a long time, have attached importance to sail seamanship only in its application to the Naval Academy and to the training service, many members of Congress assume that officers believe that sail seamanship in large degree constitutes an important part of the seamanship of the general service; hence it was sometimes declared by members of Congress that seamanship had gone to the engine-room. Now that the engineers have been absorbed into the line it is probable that we shall hear no more about seamanship having gone to the engine-room.

Various arguments are presented from time to time as to the continued need for sail instruction at the Naval Academy. One is that the cadet is thereby fitted to bring sailing prizes into port in case of war. A young officer a few years after graduation is no more fit to sail a sailing ship than a young lawyer is fit to manage a difficult case, or a young doctor to take charge of a difficult case, under a similar condition of lapse of practice. Practice subsequent to graduation is absolutely essential to make a sailor for sailing ships. Moreover, sailing prizes will probably be destroyed at sea.

During the four years that I was head of the Department of Seamanship at the Naval Academy, I was continually hampered in my desire to progress in the program of studies by a persistent insistence on the importance of sail. In certain influential directions it was even then asserted that our cruisers should continue to carry sail. This was from 1887 to 1891. It was argued in favor of practice with sail that it prepared the cadets to "meet emergencies." Here is how it really worked. The first-classmen of cadets took charge of the deck on board the sailing ships only on one practice cruise of three months, or 90 days. They alone of the cadets had anything to do with control in emergencies under sail. Assuming the first class to have had thirty members, for the sake of argument, and each one to have had an equal amount of deck duty, none could have had more than three whole days, or 72 hours,

with the trumpet in hand, one of which days, owing to the itinerary of the cruise, must have been in port. Now think of the waste of time in study and practice in old seamanship during the whole Academic course, to lead up to this result so far as emergencies were concerned.

Again, while in charge of the Department of Seamanship at the Naval Academy, I desired to modify, in greater degree, the instruction in seamanship to conform with modern practice. In order that I might have proper authority and also that I might know what I was expected to teach, I presented a resolution to the Academic Board, declaring substantially that the term *seamanship* was meant to include the care, preservation, organization, direction, equipment, management and behavior of our naval vessels, under all conditions of weather, sea and tide, at sea and in port. My resolution was tabled, chiefly because of the influence of sail seamanship at that time. I had intended, when I took charge of the Department, to write a book on seamanship on new lines. It was my purpose to treat of mechanical appliances on shipboard in much the same fashion as elementary appliances are treated in text-books devoted to mechanism, instead of mixing up appliances indiscriminately with evolutions, orders and routine, as found in existing books on seamanship. In fact, most books on seamanship have been made up largely of the fragmentary experiences of seamen from the beginning of time. I had also intended to draw from books on naval architecture for the qualities of ships as based on their construction, and for their management and behavior under the damaged conditions of battle. I received so little encouragement from any source that I was obliged to feel that in writing a book I would only have my trouble for my pains. Therefore I abandoned my purpose, as I have always believed, chiefly through the operation of the opinions of other officers who favored the retention of sail exercise as a matter of great importance.

As a rule we are slow to abandon established ways and things. We are more willing to adopt things entirely original in respect to application. The patent capstan—chain direct to the capstan—had a hard fight to gain its place, so had metal straps, slings and rigging. Steam was resisted long and earnestly. Sail in large cruising ships forced its way into the new steel navy—even into the design, at least, of the old Maine. Smooth-bore guns made our wooden steamers museums of antiquity long after every other nation had abandoned smooth-bore guns. Metal for ships' hulls had a hard wrestle with wood, and so had steel with iron. Until quite recently it was desecration to use any other than white and black paints on board our men-of-war. Why was it that the principles of ornament and decoration collapsed at the beach? Several years ago, in the hope of sympathy for my side, I complained to one excellent officer that another excellent officer had prophesied that sail exercise would be the gymnastics of the training service for fifty years. "Yes, for one hundred years," was the response. Verily the route of the reformer is full of snags.

The opinions that I have stated I have expressed frequently during the last fifteen years. My views are certainly much nearer realization now than they were fifteen years ago.

Before closing it is perhaps well to call attention to the fact that the environment of the naval apprentice on board a sailing ship or a square-rigged steamer is not the environment of the general service. He is associated with antiquities in every direction, and he is using up time which should be largely expended in acquainting himself with the complex details of modern construction and with modern shipboard terminology.

Captain C. H. DAVIS, U. S. N.—I am tempted to offer a few words in support of Captain Chadwick's argument, not because I can improve upon it, but because I have always been an advocate of a sailing-ship training for both men and officers, have, perhaps, had an exceptional early experience in sailing ships, and have commanded a squadron of cruising training ships. I have very pronounced and distinct ideas on the subject of training by sail.

I believe I am familiar with the arguments used against sailing-ship training. I believe most of these arguments to be unsound. My own experience with legislators leads me to believe that because an officer advocates a training fleet of sailing ships for apprentices he is not in any danger of being understood as an advocate of sail-power for modern battleships; and that it is comparatively easy to convince the intelligent legislator that a sailor may be produced by taking the apprentice to sea in a sailing ship, while it has been somewhat difficult to induce him to believe that a raw lad may be taken off a prairie farm, trained in a barracks, and graduated a seaman. To say that in the four years course at the Academy a cadet gets only about three hours actual experience with the trumpet hardly tells as strongly against the sailing ship as against the Academy itself. As to the question of environment, the sea itself is after all the environment of the seaman. Therefore that which tends to accustom him the most readily to the sea is the best medium of early training. It is a familiar truth that the sailing-ship officer and the sailing-ship seaman are good in anything that swims.

I approach this subject with some hesitation because I am by nature conservative. I dislike change for the sake of change. But I believe that that sentiment of conservatism, which has been general in the service, and which has been made the subject of criticism, was the very force which carried us through the disastrous years of decadence following the civil war, and fitted us for the great changes which were to come when the Navy was to be rebuilt in steel. Admiral Porter was much derided for rigging every gun-boat with full sail power, for we had the advocates of mastless ships even in those days. But that sail power carried our old black hulks to every sea and station, and kept the service and the spirit of the service alive when it was an alternative between sail and extinction, when few cared whence or how we came or whither we went. The service cannot justly be accused of an opinionated resistance to modern conditions when a change to such conditions became possible. I do not think that is a just charge against a service which has from its very beginning led the way in improvement and innovation, whenever it was possible and profitable to do so.

Now no better or finer man was ever produced, either ashore or afloat, in any sphere of life or in any time, than the sailing-ship seaman. He existed because conditions justified and demanded his existence. He can be produced again only under conditions which shall again demand him. Therefore it were senseless to expect to revive the sailing-ship seaman and make him that and nothing else. But the best traits and the best qualities which he had can be revived by an early training which shall assimilate to the old conditions, provided that the service at large is bent upon it and determined that this is the best way of commencing the training of a seaman. I insist upon this as a *sine qua non* of a revival of training under sail. It must be done in dead earnest, and with the firm conviction that such a system is the best possible school for seamen, or it had better be let alone.

If the so-called training ships are to be towed in and out of port, if they are to be crippled with double topsails, shorn of one-third of their sail power, filled with appliances and machinery which will take them in tow in distress, illuminate them with electric lights like an excursion steamboat, or an army transport in the presence of the enemy, keep a steady stream of distilled water trickling in every apartment of the ship—in other words, if the displacement which should go to power and efficiency as a sailing machine is wasted in labor saving and luxury; and finally if these ships are to be manned for a few months in the pleasant season with a timid and awkward crew of landsmen, under officers whose experience with the trumpet is limited to three hours in four years, we may not look for a very large output of hardy seamen. The seaman cannot be raised as an exotic, nor grown under glass.

Up to 1888 or thereabouts we continued to maintain our squadron of sailing ships for apprentices. I commanded one of these, and by virtue of seniority, the squadron of three. We cruised constantly in company for two years. I believe no better, quicker or more efficient system of training for boys, and incidentally for officers, ever existed. It was deliberately abandoned when there was nothing better to substitute than a brick building. It could be revived if the service were so determined. One thing that impressed me most strongly in this system was the rapidity with which it worked. At the risk of garrulity I venture to recount an incident of that cruise. While the ship was lying in Hampton Roads a young ensign just promoted reported on board one morning for duty. He was assigned to deck duty immediately, had the afternoon watch, and at one o'clock the ship was got under way to beat out with the ebb tide, the wind being fresh at S. E. The tacks were no sooner aboard than she went about, the executive officer being still on deck. Then the trumpet was handed to our young friend, who had had just the required three hours previous experience, and almost simultaneously the order was given him to tack again. I stood behind him on the horse-block and coached him—put the words of command into his mouth. From a state of extreme nervousness his confidence awoke when he saw how easy it was when one knew how, and when he realized that a trained and eager crew was his own to command, boatswains mates his lieuten-

ants, and a mighty and complex machine his plaything. The second time we tacked close under the Thimble Light, and he hardly needed coaching at all. A word when to haul the main-yard was about all. When that young man turned over the deck at four o'clock to an old lieutenant, he felt himself his equal, and a new man. Four hours on the deck of a sailing ship had changed him. I cannot bring myself to believe that such lessons are futile, or that they might not be revived with profit, if the service so willed and determined.

Commander W. J. BARNETTE, U. S. N.—I can add nothing to the force of Captain Chadwick's reasoning, for his conclusions are sound. The stock argument against the sailing ship training is that it is a great waste of time, and that there is so much to learn no time can afford to be wasted.

As a sailing ship tests all the faculties of the seaman to the fullest extent, that system surely cannot be time thrown away. I venture to say that none of the older officers who have had more or less square-rig sailing will be found on the side opposed to this system of training. Opposed to it would be those whose opinions had been formed from their practice cruises—an experience too limited for forming a sound judgment. Who then should be considered best able to judge as to the system of training which will produce the best results—those who have served both in the old and the new or those who have had little but the new?

I have yet to hear any one say that the commanding and executive officers of our new ships have been unequal to their duties because of their early training in sailing ships. When an officer feels that he has mastered a sailing ship there is nothing in the new Navy that will shake his confidence in himself or cause him any great amount of worry.

The English officers are evidently still divided on this subject, though on a recent cruise to the West Indies I had the pleasure of lunching with three English captains who were unanimous in saying that if they had the selecting of their first lieutenants they would always prefer those who had been through their training-brigs.

An officer who recently left the "Saratoga" for duty on one of our steamers bound for Manila wrote me in mid-ocean that they were struck by a heavy squall and all he had to do as officer of the deck was to haul over the hatch-hoods and send for his raincoat. That simple statement tells a whole story to those who know a sailing ship.

If the sailing ship be so valuable to an officer it must be in a like degree to the seaman. I say with Captain Chadwick, by all means give us the square-rigger for training both officers and men.

I am very glad to note that the Department is following this system so far as lies in its power.

Lieut.-Commander A. C. DILLINGHAM, U. S. N.—In considering the paper written by Captain Chadwick, relative to the training of seamen, I beg to state that I agree entirely with Captain Chadwick's views.

I have had the advantages of having served aboard a sailing training ship, and of being executive of a battleship where I was able to compare the worth of a sailing ship, with steamboat training.

Training on a sailing ship develops the lad's mental resources, gives him independent thought, with a habit of looking at things aboard ship with a sailor-man's eye. It develops the faculty of considering more than one thing at the same time, exercising the mind in such a way as to broaden the nautical intellect; it gives ship and sea habit in a way that no other service can do, and a lad brought up on a sailing vessel has his nautical faculties so developed that he is away to windward, in his efficiency of work aboard the modern man-of-war, of the lad who has not had this nautical training. In the modern man-of-war, the lad is lost to everything but his own particular part of the ship; he may be shifted around from one part of the ship to the other, but he has not always before him the whole ship, as he has in a sailing vessel, where in working his part he sees the working of other parts—this gives greater freedom of thought in a greater view, a broader sphere of thought, which without effort on the lad's part, develops or educates the mind and takes him to a modern ship much better developed in character, for efficient service in his fighting sphere.

On a sailing vessel the lad acquires the habit of going from one thing to another to get a result—from clewlines to buntlines, from after braces to the head braces, for instance.

By this habit he is better prepared for service on the modern ship, where in fighting service he must go himself instead of having to be led.

The difference between a sailing-ship-trained lad and a steamboat-trained lad is very apparent aboard our fighting ships.

The sailing-ship-trained lad will rig a coaling derrick, reeve off and lead out the fall, where the steamboat-trained lad waits to have the fall put in his hands.

He has an alertness and a quick perception; he is a "handy man" from the boat crane or coaling derrick to the mechanism of a machine gun. In the turret he shows the good results of his nautical training on the sailing vessel, by his quick perception and alertness and readiness to adapt himself to circumstances.

You will find sailing-ship-trained lads who can drop from the smoke hatch of a turret to the handling room below, opening always the proper valves as they go down, displaying the faculty acquired on a sailing ship, of being able to look ahead, of considering at the same instant, the parts necessary to make the whole.

Training on a sailing ship develops the lad, physically and mentally, broadens his perceptions, gives him self-reliance and courage and broader views, alertness and nimbleness, that will stick to him forever, no matter where he may serve.

He has acquired ship and sea habit more permanently, and sooner, than he could have done on a modern fighting machine.

To make a sailor he must go to sea, and I believe that sea service on a sailing ship has innumerable advantages over steamboat training.

Aboard of a sailing ship there is always the working of the ship, if it is only the trimming of sails that keeps the minds of the men on deck occupied with thoughts of their profession and keeps up an interest which becomes lasting, and in its effects, trains the mind to alertness and interest in seaman-like doings.

This is always the case, so long as the sailing ship is under way, but in the steamer far different, after the anchor is fished, there is nothing of interest, so far as the movement of the ship is concerned, and the lad under training lapses into idleness and laziness, both of body and mind, to be aroused only by a call to dump ashes or to trim ventilators.

These qualities, "courage, resourcefulness, activity and strength," developed in training on a sailing ship, are all elements that make up the character of the man we need for seaman.

Rear Admiral W. C. GIBSON, U. S. N.—I have read with great interest the paper by Captain Chadwick, U. S. N., sent to me for "criticism and opinions."

I agree with the author in all that he says in favor of training boys in sailing ships. In my opinion there is no school like it or equal to it.

I cannot say that I would go so far as to banish the steam engine entirely. In my own experience in command of a training ship I found it exceedingly useful in reaching port after a cruise which had been lengthened by unfavorable winds. I believe that in a training ship, steam should only be used for entering and leaving harbors.

In ships having steam power there are facilities for instructing such of the apprentices as are so inclined in the duties of the engine and fire room.

Lieut.-Commander J. B. MURDOCK, U. S. N.—I most fully agree with the views expressed by Captain Chadwick in his letter. There is nothing like cruising under canvas to develop the resourcefulness and general usefulness we so much need in our service. There are plenty of chances given for training specialists, and developing a man's capacity in one direction, but a general fundamental training in the seafaring habit cannot well be obtained either in barracks, workshops, or even aboard our men-of-war. As the best college training aims at a general development and broadening of the mental faculties as a preliminary for future special work, so our naval training will be better if it rests at bottom on the acquisition of the seafaring method of life and thought which has characterized good seamen since commerce began. And if apprentices acquire this early in life, they will be vastly better men for the service. I have always believed in the barrack system as affording the best means for rapidly breaking the recruit into discipline and to habits of obedience, but it needs a supplement afloat, and nothing seems so well adapted to give what is needed as the sailing ship. When the apprentice then enters the general service he comes with the broad foundations of his training well laid, and is fitted for any special training for which he may show aptitude.

Lieut.-Commander E. B. UNDERWOOD, U. S. N.—Captain Chadwick has done the service a good turn in emphasizing the necessity of sending our apprentices, for their preliminary training, from the training station to a sailing training ship, rather than to a steamer.

During this formative period of their lives, it is my opinion that they will derive much more benefit from a cruise in a sailing vessel—a square-rigger—than from one in a steamer. After they have been transferred to the battleship or the cruiser, they are not too old to learn the part of their technical education that cannot be acquired on board a sailing vessel.

What quality is more desirable in a man-of-war's man than that called "contempt of danger"? It must be obvious that this hardihood can better than anywhere else be acquired by drills aloft in all sorts of weather in a sailing ship. For physical development, too, how far ahead are the drills aloft when compared to the ordinary "setting up" drill of mastless vessels.

There is another point that ought not to be lost sight of. We hear that the aggregate tramp steamer tonnage is ever increasing, but it will be many years before the sailing freighter is driven from the sea. If, then, we should engage in a war with a power having a respectable merchant marine, it is fair to infer that we should find some sailing vessels on our hands as prizes. Great, in that case, would be the necessity of having for prize crews officers and men skilled in the management of sailing vessels. It ought to be plain, then, that, for educational purposes, our sailing training ships are especially valuable, for the young officer as well as for the apprentice.

In connection with this subject, I would like to call attention to the desirability of having the petty officers and seamen of the training ships picked men, men that are sailors, not in name only but in reality.

During the past two years I have served successively in the training ships Alliance and Topeka. The former, long time in commission, had a most capable crew, one that it was a pleasure to serve with. The Topeka, on the contrary, newly commissioned, had a crew many of whom were not sailors at all but "steamers" (if I may be permitted so to use this word). Their service had been entirely in steamers and they knew nothing about the duties of a seaman, in the meaning given to the word a generation ago. In the sail and spar drills of the early part of the cruise, the attention of the officers had to be occupied, in a large degree, with petty officers and seamen aloft, and to that extent the landsmen for training were sufferers. It would seem to be feasible to anticipate by a few weeks or months the commissioning of a training ship, in which time it ought to be possible to collect on board the nearest receiving ship, either by enlistment or by transfer from the vessels of the fleet, men who are, in the proper acceptation of the term, seamen.

By all means, then, let our apprentices be given their early training in sailing vessels, and let these sailing vessels be given the right kind of crews.

Lieut.-Commander W. F. FULLAM, U. S. N.—It is most unfortunate for the Navy that the modern ship has been habitually referred to as a mass of complicated machinery, a floating fort, an arsenal, magazine, and machine shop combined. Quite naturally, the people at large, who look at these "awful monsters," these "fighting machines," with open-eyed wonder, jump at once to the conclusion that the men to man and fight them should no longer be trained as sailors but rather as machinists, gunners, and electricians. And not a few naval officers, actuated by a praiseworthy desire to keep pace with naval development, have been driven by the seeming logic of events to advocate a machine-shop training for men-of-war's men! Others, while not failing to realize that in passing from the sailing frigate to the battleship there must necessarily be a change in the education and training of the man-of-war's man, are not so far deceived as to favor the practical abolition of sailors in the Navy.

Captain Chadwick's treatment of the subject is most happy in that he distinguishes between the "development of character" and the "acquirement of information" in the training of seamen. And this very sensible view of the matter, which does not ignore the machines, the guns, and the dynamos, may serve to allay the fears of many zealous up-to-date naval officers, who, in their anxious opposition to all conservative influences, condemn the sailing ship as a relic of antiquity and an unfit place to train recruits for a modern navy.

Captain Chadwick strikes a "happy mean." We need not continue to produce sailors of the old school, and we need not confine ourselves to machinery, and to things mechanical in the training of landsmen and apprentices. But we should, by all means, endeavor to develop and retain that "handiness," physical activity, fearlessness, and quickness of the eye which distinguished the old time sailor—qualities which can be bred nowhere so surely or successfully as in a full-rigged sailing ship. In short, let us keep all that is *good*, get rid of all that is *bad* in the sailor, and *add* the military and mechanical education that is necessary to efficiency.

The "development of character," as Captain Chadwick puts it—the preliminary physical and mental drill, the strictly seaman's training which gives us a quick, athletic, handy, all-around man—need not continue longer than a year if we are pressed for time. *Then* we may send the graduate to a modern cruising ship for the "acquirement of information" during the remainder of his career. He will quickly learn to handle machines and guns, and when called upon to man a boat, sling a stage over the side, shin up a signal mast, or *handle himself* generally in the daily routine of a battleship, he will be found superior to the machine-shop product every time. The moral effect of even six months training aloft in a sailing ship will be lasting and invaluable.

It is sincerely to be hoped that Captain Chadwick's solution—develop character, activity, handiness and fearlessness, *first* in the young naval recruit, and then *finish* his training with machines and guns—may be acceptable to all officers, for it marks out a neutral ground upon which

the conscientious advocates of two opposing theories can safely and unitedly stand for the accomplishment of a common purpose.

Lieut.-Commander W. L. RODGERS, U. S. N.—I agree entirely with Captain Chadwick's views when he says that the old-fashioned training aloft in sailing ships produced handy, resourceful and courageous men, developing character such as we need now. I doubt, however, whether we may hope to produce such men by the old methods in the present day.

In the first place, the newspapers throughout the country have been assuring the public in general and the Naval Committees of Congress in particular that the man-of-war's man of to-day is a product of education and environment altogether different from the heroes of Marryatt and Cooper. The seed has fallen on good ground, and is bearing abundant fruit. I understand that when the Navy Department urged appropriations last year for sailing craft for the training squadron, it was found impossible to make any impression on Congress, and I do not believe it can be done hereafter. Our spars will last no longer than our present ships can carry them. For a congressman does not readily see that a good royal yard man is particularly fitted to handle an electrically controlled turret. The idea does not fit with his preconceived notions of business and life.

In the second place few of the officers and none of the petty officers and men who now serve as instructors in the training service have served on a smart sailing ship of the old type; they are not expert themselves in what they are expected to teach. Moreover, all the younger element, including officers, men and apprentices, look on spars as something obsolete, and have no appreciation of the lessons which may be gained from drill aloft. Therefore nobody takes as keen an interest as was formerly the case.

Thus the best efforts of captain and executive cannot develop that liveliness and promptness which was the rule years ago when sails were still a live issue.

To try to maintain a sailing squadron is to fight against the stars in their courses. When the lieutenants of to-day reach command rank it is certain that they will abjure sails and any effort to prolong their existence in the Navy will only make the transition more embarrassing when it is suddenly forced on us by the retirement of our present wooden ships; all of them already old.

These considerations make me willing to accept mastless ships for training that we may learn how to get on when we have no other means of dealing with recruits.

We must find out how to make modern drills produce the activity, resourcefulness and handiness which spar drill once did, but which none of the younger officers now know how to utilize for this object. Let us then devote our efforts to boat drill, under oars and sail, to infantry; to mining and countermining, as well as to great guns and target practice; and if in no other way, the service will benefit by better health and endurance than is usual at present on mastless ships. Any one going from a

training ship to a mastless one at once notices the clearer complexions and heartier appearance of the recruits under training.

The drills just mentioned have never been developed to the utmost in our service, but if they should be, there can be no doubt that the resource and intelligence of the crews would be developed to a great degree, even if not so highly as with masted ships. In boat work exercises under oars and sail in all weathers should be the rule in port and at sea. When near good beaches in warm climates the whale boats should land through the surf when not too rough, and at sea "abandon ship" should frequently be carried out, making sail after shoving off. Infantry drill should include target practice, when advancing in open order, together with tactical work in the field, embracing scouting and manœuvring against opposing forces. In this way much may be done to develop intelligence and readiness. Laying dummy mines and operating against them by dragging and sweeping is a fine exercise in seamanship.

Altogether, I think, modern drills offer very nearly as good a field for development of character as the old ones, after we shall have had a little experience in utilizing them for the purpose. Besides they offer the great advantage that people think them useful and modern and so take an interest in them which is lacking with sail drill.

It is unfortunate that with a force inadequate to man all our ships, we find it advisable to absorb such a large percentage of it in training service.

My observation, both of apprentices and landsmen under instruction, leads me to believe that the principal training they pick up is in the way of obedience, good manners, cleanliness of person and of clothing, together with a general idea of ship's routine. Their knowledge of seamanship and other drills acquired at the same time is secondary in importance to their development of habits and character. I am of opinion that six months at a training barracks by the sea would teach them all this nearly as well as if they were afloat. Then they should be transferred to the larger ships in regular service and take part in all the ship's work and exercises until noon. In the afternoon there should be special exercises for recruits and this instruction should be regular and progressive.

In this way the greater part of the force employed in the training ships would become available to commission four or five battleships; for comparatively few officers and petty officers could manage the barracks, some of which exist even now.

Our seamen who fought in 1812 were as good as any; and they were trained in regular cruisers without any special training ships, and we can do as well now.

The only difficulty is that it would be necessary for the Department to make an effort to see that every ship carrying recruits for training really does give them the necessary attention.

This is a real difficulty; for it must be acknowledged that the Department's methods of control of ships afloat, except in matters of the purse, are not yet perfected.

It is interesting as a matter of history, to note how for a hundred years the Department has been making earnest efforts to increase its

authority and control in matters of routine and administration, and how unsatisfactory are the results so far accomplished.

The reason undoubtedly is that it has tried to rule too exclusively through regulations and correspondence, when it is absolutely necessary to keep in touch with the Navy and establish effective supervision by personal inspection through a body of officers detailed for the purpose and reporting direct to the Department as does the Inspection Corps of the Army.

Lieutenant GEO. R. CLARKE, U. S. N.—Captain Chadwick has done good service in again calling attention to that most important subject, the training of men and boys. In the close attention given to modern appliances and equipments, electrical and mechanical, it is well not to overlook the importance of this branch of the officer's education, the study of the men collectively and individually, with a view to getting the best out of crews on board our ships. A neglect of this study results in waste of material, so to speak, in "rubbing men the wrong way"; in having a disgruntled, dissatisfied crew in whose hands the best equipped ship is inefficient, or, at any rate, not at her best.

I think that the training ships should have auxiliary steam power to enable them to enter and leave port, and to better follow a pre-arranged itinerary. All the benefits of sail drill can be had in the long stretches at sea. The manœuvre of entering and leaving port is a drill, not so much for the boy as for the officer. Then, too, it is important to keep the boys in a cheerful frame of mind, as free from discouragement and disappointment as possible. Those who have been in the training service know that after a quick passage across the Atlantic, an unfortunate shift of wind may occur and keep the ship out as many days as she has taken to make the run from port to port. This has a most unfortunate effect upon the boys, and they are the ones we are considering.

Again, while it may be regarded as providing for a remote contingency, it is yet worth while to consider the possibility, in these days of "war's stern (and sudden) alarums," of a training squadron being caught out, an easy and tempting mark for the enemy's cruisers. With steam power they would be far less helpless. I know that this part of the subject was often a matter of discussion on the practice cruise of '97.

Lieut. JOHN M. ELLICOTT, U. S. N.—I am glad to be permitted the opportunity to express my hearty agreement with the views of Captain Chadwick as to the training of seamen.

If action is taken in accordance with these views, however, we should guard against the natural economic inclination to rehabilitate old sailing vessels, or old type vessels which might be converted into sailers, for training purposes. Resourcefulness and handiness in the sailor need the incentive of *esprit;* and the latter should be cultivated as much as the former qualities. Sailing ships for the training of seamen should not be improvised from old material, but should be newly constructed with a view to making them excel in speed, handiness, weatherliness, and modern

comforts anything of their class afloat, so that those who man them may take pride in their superiority and feel impelled to put forth every effort to maintain it.

I would suggest in connection with these remarks, that it might be well to have our Naval Attache at Berlin inspect the Grossherzogin Elizabeth now completing under the supervision of the German Training-ship Society for the training of sailors for the German Merchant Marine. I suspect that on a somewhat larger displacement, and with a battery, she would be about what we need.

Lieut. J. L. JAYNE, U. S. N.—Since the Chief of the Bureau of Navigation and the Institute have invited discussion of Captain Chadwick's letter, I presume that a general expression of opinion is desired, and I therefore take the opportunity of casting my vote for the preliminary training of apprentices in sailing ships armed with modern guns, because I believe that there is no better way of developing certain qualities which our modern seamen should possess, because much of the knowledge thus gained will be useful to them in any ship and their minds are thus trained to readily grasp the particular duties required on any ship, and because such a large percentage of the merchant tonnage of the world is propelled by sail that I think it desirable that our seamen should have knowledge of that method of propulsion.

I think it desirable to equip training ships with auxiliary steam power to operate dynamos, ventilators, etc., to contribute to the comfort of their crews. Since the rapid development of seamen will require the ships to be much of the time at sea, every effort should be made to make the life attractive and thereby save to the service many valuable boys who might become discontented if not provided with means of enjoyment. I do not mean that discipline should be relaxed. On the contrary, I believe that it should be strict, for if apprentices are not properly trained in this respect they are apt to give trouble in the future.

I think that the officers for this service, and especially the commanding and executive officers, should be carefully selected, and, if possible, only those who are interested in it detailed for it.

Lieutenant A. A. ACKERMAN, U. S. N.—Captain Chadwick's letter is a strong appeal for the development of character in the young apprentice. The acquirement of information is to be regarded as secondary. The qualities of courage, resourcefulness, activity and strength are grand ones. They not only make the "handy man" on board ship, but they make the *man* in the highest physical sense, no matter what his vocation.

There are those, however, who question the fundamental proposition: Do we want Jacks-of-all-trades and masters of none on modern cruisers and battleships? Don't those people often go to sea because they can't get along on shore? Isn't the capacity of the old salt for bungling when he "overhauls" a modern gun mount, truly appalling? Are even the officers, prepared as they are in theory, able to absorb all the details of a battleship in a few months?

It is well understood that gymnastics develop courage, and none are more healthful than sail and spar drills. It is also agreed that the knowledge of routine work on sailing vessels is of value to all who go to sea; as a preventer if for nothing else, but in this case there seems no good reason for reeving off the preventer before any other rigging is up.

In our broad land with its many millions of workers, what percentage can be found following the sea for a livelihood? Is that percentage as great as in Scandinavia, or Great Britain, or in the Malay Archipelago, and do our people suffer by contrast in enterprise, resourcefulness or courage? Is not the merchant sailor one of the most helpless creatures to be found in a great city? In spite of the development of his character, does he either meet with much consideration at sea or find his training help him in the jostling crowd on shore?

There has been a time when it was actually proposed to keep our blue jackets in the service, like wing-clipped pigeons, through their very helplessness among their free fellows on shore. That time of reproach is past.

The modern blue jacket has not so much to do with the forces of nature in their elemental shape as he has with those of man in some of their highest and most complicated forms.

The higher the standard of our ratings among the kindred trades and professions on shore, the more certain the Navy will be to receive full consideration for its unquestioned merits and services. This is as true for the youngest apprentice as it is for the highest officer. The more certain too will parents be that the love of adventure that causes their boys to long for life at sea, will not result in years of wasted time. The more certain that a graduate apprentice, should he elect to remain on shore, will announce with pride rather than conceal his enlistment.

We are all aware of the comforts to be had with a docile ox-like crew of men, skilled in gun-lacquer and the mysteries of bright work, who will follow the routine steadfastly from all hands to pipe down with no thought of the future. Such a life, however, once sampled by the average young American, has no further attractions. We want our Navy to be American, but Americans as a people are intelligent and ambitious. Youth is commonly thoughtless and lives in the present, but it is doubted if there are not many of the boys on our training ships who do not fret at the delay and round-about path to actual service. There is not a trade in the land that is as wasteful of the time of its apprentices as we in the Navy; not a trade that goes so far afield to teach that which is right at hand.

The questions may be asked, are our apprentices instructed in those *simplicities* of our ships, injury to which send some of them so often to Navy Yards for repairs? Have they learned a better way to get a shaft into its bearing than by brute force? Do they know as much about a hydraulic jack as they do about a reef-tackle? Can they loosen a rusted bolt or put on its nut as well as they can make a Turk's Head? Have they learned what to do with rusted iron work? Can they read a drawing and follow the windings of an electric wire or drain pipe on a ship's plan?

In fact, can they help their officers take care of the ship, or is their very ignorance a source of danger to the equipment?

It is hard to eliminate sentiment from many of the most important questions arising in naval administration. The very cobbles along the road of the glorious past seem hallowed; used with judgment they might mend the way of the present, but sentiment insists on sacrifice and would often turn them into stumbling blocks. The realm of sentiment has no law; it is a land of regrets or enthusiasm, often as unfounded as unreasonable; still the man who never ventures into it is scarcely more than a machine. So it may be with regret; it should be at any rate with respect and veneration, that we turn from the worn problems of past conditions to those of the present.

Lieut. F. A. TRAUT, U. S. N.—Having previously had a few months' service at the Training Station, I came to the Monongahela a year and a half ago in doubt as to the relative merits of steamers and sailing ships for the training of apprentices, but rather inclined to condemn the latter. I have since become convinced, however, of the correctness of the views expressed in Capt. Chadwick's letter, and am glad of an opportunity to express myself in perfect accord with them.

We can train gunners on board a steamer, but if we want the apprentice to become the sort of man described by Capt. Chadwick there is no doubt in my mind that the sailing ship is better adapted to the purpose; nor is a short term of service on a sailing training ship anything but beneficial to the young officer as well.

Commander RICHARD WAINWRIGHT, U. S. N.—No one, who has been trained in sailing ships and has seen the results and assisted in the training of others in sailing ships, can deny the great advantage of such training in the formation of character. The American seaman is unsurpassed in adaptability, readiness in emergency and courage. Some of this is due to American character, as the above qualities are found to exist to a large extent in Americans under any decent training, and much is due to the training under sail.

No one who has grown up in the service when the motive power was mostly sails or hand power, and has witnessed the change to ships filled with machinery run by steam or electricity, can have failed to notice the want of mechanical ability in the best American seamen. A fine old quartermaster can ruin more telescopes and binoculars than a young apprentice. And the old-fashioned boatswain's mate or quartermaster will soon wear out an anchor engine or gun carriage. An old seaman is adaptable; he readily learns to run a machine, to do makeshift repairing; but he cannot run it economically, he cannot keep it in good repair. He is a fine jack-of-all-trades but not a master mechanic.

Few who have been trained with sails but have felt, when on a modern ship, the want of that concurrence of eye and hand called mechanical ability. The ordinary man can only acquire this by early training with tools, and about machinery. For our leading petty officers' and war-

rant officers' mechanical ability is a necessity. We look to our apprentice system to produce these men, and if the boys are not given early mechanical training, they will be crowded out in many cases by those of the landsmen training under the new system, who have had early mechanical training and have good American characters.

To produce the best results our apprentices, when on shore, must be trained in work-shops as well as in boats and on the drill ground. When at sea, acquiring the sea habit, so necessary to all classes of seamen, they must be in ships with modern machinery. They should be on ships with sail power, when possible, so that the polish of the sailor can be added in forming the character of the seaman.

I believe that with ships containing modern machinery, but also square-rigged, the apprentice can gain a valuable amount of sailorizing without detracting from his mechanical knowledge.

The modern seaman must have mechanical ability, and must acquire it by early training. The formation of his character can be greatly assisted by some training with spars and sails. The acquirement of knowledge and the formation of character must go together, hand in hand.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AN ADDRESS DELIVERED BEFORE THE NAVAL WAR COLLEGE, NEWPORT, R. I.*

By the HON. FRANK WARREN HACKETT, Asst. Secy. of the Navy.

Mr. President and Gentlemen of the War College:

A year ago the honor and pleasure were mine of coming here, as a messenger, bringing to you the hearty greetings of the Navy Department. To-day I am the bearer of like good cheer. I trust that, in order to be regarded as in some sense an old friend, I need not be driven to the expedient of reminding you that during the interval we have stepped from one century into another. At all events, I can assure you that the Secretary of the Navy and those associated with him note with increasing satisfaction all that your faithful labor is accomplishing at the War College.

The enterprise is now well beyond the stage of experiment. Its friends can have no fears for the future.

Seventeen years have passed since the first steps were taken to bring into being an institution that should provide for the "higher education" of officers of the Navy. During its early struggle for existence, the Naval War College met and dissipated that cloud of prejudices which is almost sure to envelope a project in its nature novel and experimental. The College has survived for the reason that faith has been kept with the promises of those who stood as its sponsors.

Already how excellent is the record. How clearly do we now see that the work done within these walls lifts the officer into a higher atmosphere, broadens his conceptions, and brings him

* At the annual opening, June 3, 1901.

distinctly nearer to that ideal standard of development which it has ever been the aspiration of the American Navy to attain.

The hour and the place are propitious for an expression of grateful acknowledgment to the accomplished officer and gentleman to whom belongs the honored title of the founder of the Naval War College. His long and busy career has been characterized at every step by an ardent desire to improve and elevate the profession which he so conspicuously adorns. In the exercise of a foresight of the highest order, this true type of an American sailor "turned to" (if I may borrow Jack's handy phase) and brought to bear upon those in authority such force of argument, and such well-directed energy, that Congress enacted the desired legislation and gave to the country a Naval War College, the first institution of the kind that the world has ever known.

It was the dawn of new era for the Navy.

To our good friend likewise is credit due that the institution was established where it should be—here in this historic harbor, a locality as affluent of advantage as it is of delights.

To the founder and constant helper of the War College, Rear Admiral Stephen Bleecker Luce, we extend a tribute of praise and sincere thanks. We persuade ourselves that Time likes to deal gently with him, so that the War College may still look for counsel to its Nestor during many a year to come.

What the college is, what its aims and purposes, and to what extent it may claim to have answered the hopes of those who from the first have believed in it, is to be taken, I assume, as fairly well known to all from cadet to admiral.

But it is not alone officers of the Navy who are watching with interest what you do here. That our ships, with their complement of officers and men, shall be kept always at the highest point of efficiency, ready upon the instant for war, is an object of concern to every citizen in the land.

We need not apprehend that the day shall come when an American, whether living on the coast or far inland, is indifferent to the status of his Navy. The people are alive to what you are doing here. They are well aware how much to them your work signifies of protection and security. They recognize the fact that it is for them that the War College opens its doors to annual classes; for them that the trained mind is still further disciplined,

made more alert, more resourceful, more familiar with the conditions and problems of actual war.

Since the development of our naval strength must rely upon the influences of an enlightened public opinion, we welcome the opportunity afforded by the annual opening of the course thus to remind the country at large of the results here attained.

The fact that the people, one and all, look upon their Navy with affection is to be attributed to something more than sentiment. To be sure, the sea and what is done upon it has in every age laid a spell upon the imagination of man. Allow for this subtile agency, there yet remains on all sides a conviction that American valor and prowess on the ocean are racial in origin; that it is to be counted on as a natural outcome of free institutions such as ours. The support ungrudgingly given by the country to its naval establishment furnishes to every officer and to every enlisted man an incentive to do his utmost to make the service worthy of public confidence and pride.

But how is an officer to do his utmost? To ask the question is to bring us to the consideration of what is submitted as the leading thought of this address, namely, that every officer of the Navy for the period of his active service should undergo a continuing process of education and training—not partial and fitful, but without remission.

Were you at this moment to confront me with the query, What ought an officer of the United States Navy to be? I should refer you to the text of a letter penned by as great a man as ever sailed under any flag, John Paul Jones. It bears date September 14, 1775, and is addressed to Mr. Hewes, of the Provisional Marine Committee of the Continental Congress. Read this remarkable letter, and you are advised of precisely those qualifications that a naval officer should possess. Its concise, direct terms are for all time. The description stands forth just as apt and as sufficient at this hour as it was when the author wrote it.

Let me add in passing, that readers of the recently published Life of John Paul Jones, by Mr. Buell, cannot too warmly thank that writer for his industry in bringing to light new material, and his skill in revealing to us the grand proportions of the man of whom he writes. Hitherto the world had known Paul Jones simply and exclusively as a sea fighter, the foremost of any age. We now, and most of us for the first time, see in him a statesman,

a diplomat of rare ability, and an accomplished man of the world. At last an adequate conception of our hero being thus presented to his countrymen, it would be an act of tardy justice to set up at Washington a memorial of John Paul Jones, where as yet none exists. Surely his statue deserves to occupy a place of honor at the Navy Department.

Much in the same way, were reasons to be demanded of me for maintaining the Naval War College, I should bid the questioner turn to the report of a board appointed by Secretary Chandler, May 3, 1884, to deal with the subject. This document, which is to be found in the Report of the Secretary of the Navy for 1885, is signed by Commodore S. B. Luce, Commander W. T. Sampson, and Lieutenant Commander C. F. Goodrich. The board did their work well. Their report sets forth the need of an institution such as this, and briefly outlines the scope of what it might hope to compass. The thought occurs that you may do worse than to put a copy of this instructive paper into the hands of each newcomer upon his reporting here for duty.

Here one finds a school where facilities are offered for that broader training which is demanded of those having in charge our modern ships of war. In days gone by, it used to be taken for granted that the attainment of high rank meant that the culminating point of skill and efficiency had been reached. They were indeed grand old sailors. Masters of seamanship, they displayed a tact in the handling of men that was the perfection of discipline. They enjoyed, all of them, an extensive acquaintance with foreign countries, and knew something of their own, along the seaboard. Their varied experience afloat and ashore (including a list of supposed hardships which they went through as youngsters) brightened their faculties, and created the type of the American naval officer, able, accomplished, always brave, such as no country in the world has surpassed. All honor to the memory of these gallant men.

But the day of these men is not our day. Alike in business, in professional life, in affairs of state, or in the art of war, a spirit of change has done its work, and much once thought indispensable has now been discarded as outgrown. Could Paul Jones, or Truxton, or Perry, or Decatur, come back to life and set foot upon one of our armored battleships, he would indeed be lost in wonder. Boundless would be his surprise at learning to what

extent the faculties and attainments of a commanding officer are taxed to answer the demands of his position. We are safe in saying of the naval officer of the present period that he must know more things, and know them accurately, too, than was ever demanded of him who trod the quarter deck half a century ago. New problems present themselves for solution, and some of the graver ones you deal with here at the War College.

As for education in general, I confess there is a strong temptation to discourse upon so attractive a topic. It has always been the fashion, and probably it always will be, to talk more or less about education. Now and then somebody of exemplary patience tries to fathom the subject, but we seldom hear that he meets with any great success.

As early as 1644, John Milton had composed his brief Tractate, condemning the methods of education then in vogue at the universities. But the production, with all the author's learning, offered scarcely a suggestion that was of practical use; though, happily, it has enriched literature by the noblest definition of education that can be conceived: "I call a complete and generous education that which fits a man to perform justly, skilfully, and magnanimously all the offices, both public and private, of peace and war."

John Locke, in his "Thoughts Concerning Education," gave much excellent advice that some of our colonial ancestors might well have thanked him for. About a century later, Pestalozzi advanced a plausible theory or two that brought him numerous followers; while Lancaster, long afterwards, undertook to tell our grandfathers how to manage their children. Of living writers, an essay of Herbert Spencer yields food for profitable reflection.

After the printing of so many books, and after so much discussion, one might imagine that the leading principles of education would be found substantially reduced to a science. Not at all. Parents and guardians are going ahead timidly now, much as they did in former times; while the average boy or girl remains as much of a puzzle as ever. For a while we try new methods, and then set them aside for others. They in turn have to give place to something else that allures with a promise. Still, out from all this partial success and failure there has come a residuum not without value. The schoolmaster manages some-

how to keep a little in advance of his pupil, apparently reconciled to the prospect that, provided he live long enough, he is sure to be looked upon as old-fashioned.

I venture to say that there may be someone present who, by an effort of memory, can recall a phrase once applied to young ladies at a boarding school, or, as is was customary to style it, "seminary." This phrase has dropped out of currency, but when it prevailed people used to say of the young woman that she was engaged in "finishing her education." For myself, I chiefly remember the expression because of a reply attributed to Doctor Wayland, an educator of eminence in his day. It is related, I believe, of the Doctor that at the close of certain graduation exercises a young lady came up to him and exclaimed: "Congratulate me, Doctor Wayland, for I have finished my education." "Have you indeed, my child?" said the good man, smiling, "you are more fortunate than I, for I am just beginning mine."

Now that we have a Naval War College, who would dream of saying of a captain, or of a rear-admiral, that he has "finished his education."

In prescribing a plan in the nature of a curriculum, the College has kept in view one cardinal proposition: Success in war lies in preparation. A simple truth, so simple indeed that you may call it commonplace, if you like. But a maxim may go unchallenged, and yet fail to impress itself upon the hearer at the moment he should be governed by it.

Being ready signifies something beyond the ability to get your ships, guns, and men at the place you want them, the very hour you want them. It means the presence on board of a master mind, that knows how to use this force to the highest advantage, the one man who can get out of it the greatest power wherewith to defeat and crush the enemy. A master mind does not find its way to supreme command haphazard. Training and hard thinking bring it about. To have such a captain close at hand—this is preparation; this is what it is to be ready.

Only let us be prepared, the world takes notice, and here we get one of the very few conditions upon which a government can rely for conserving peace.

The Navy, a body of highly trained officers, is, it can not too earnestly be declared, sincere in hoping that a state of peace may

long continue. It is doubtful if the service contains a single individual of the right spirit who does not stand ready to approve of any well-considered plan which promises to render the possibility of war more and more remote.

You who enter upon the course now opening do so animated by a desire for peace. True, you but obey a natural instinct when you seek to perfect yourselves in the lesson of being ready. It is the first duty you owe to your profession and to the country. Still, you would have it understood that the moving impulse is, that our naval strength be kept in such a state of instant efficiency that no power will hastily provoke war with the United States.

The American people cherish good will toward all other powers, and value a like good will in return. But we perfectly comprehend of what vital moment it is that every other power be impressed at all times with a wholesome dread of having the United States for an enemy. To this end, peace-loving as we are, we have announced it to be our settled policy to maintain a powerfully equipped Navy.

The people mean that in ships and guns the United States shall hold its rightful position. They never will tolerate that our seagoing force fall into an inferior rank among the navies of the world. The largest measure of safety, they firmly believe, rests with that country whose naval authorities can put the better brain upon the bridge.

Holding this high purpose in view, you assemble here that you may engage in the task of educating yourselves; for this is a college without professor or text-book. All are students. You are to learn something of naval tactics and naval strategy. You will listen to lectures upon naval history, upon international law, and like topics; some of you will prepare and read papers dealing with naval campaigns; you will point out and discuss the causes of success or failure attending naval operations of our own and of other powers.

But the unique feature of the course is what is known as "the war game." Here one finds out empirically into what sort of a situation he is likely to be precipitated in the event that war shall suddenly come upon us. It sets a man to thinking what he had better do about it. When an officer goes away at the end of the course he carries with him a new stock of ideas. Later, upon

taking command of a ship, there would seem to be no reason why he may not improve the opportunity to impart some of these ideas to junior officers. In this way the influence of the Naval War College may be exerted in numerous directions.

The sinking of Cervera's fleet was not the execution of a plan suddenly inspired. On the contrary, that memorable July forenoon saw wrought out that which, in its beginning at least, was rehearsed, so to speak, in these very halls. An incident that occurred not long after the close of the war serves to illustrate my meaning. Rear Admiral Sampson happening to be here, saw suspended on the wall a large chart of the Cuban coast. It bore certain marks that denoted the movements of war vessels. The Admiral took it to be a chart that had recently been prepared for the purpose of illustrating certain features of the Spanish war. It turned out, as a matter of fact, that he was looking at a working model that had been put to use two years before the war in the study of an imaginary campaign against Spain.

So, too, the contingency of scouting in the West Indian waters during supposed hostilities with Spain had not been neglected. For the purpose two rooms were occupied. An officer in each room represented a contending force. Each started with a like knowledge of the number, character, and the assumed disposition of the ships of the other. Each did the best he could to fix the whereabouts of his opponent. On a signal work was stopped and the officers compared results. It is told of one accomplished commander whose ship did invaluable service as a scout on the Cuban coast, that while thus engaged he found the work strangely familiar, and said of it: "Why, it seems as though I am sure later on to hear Taylor's bell."

Another illustration of the benefits of the instruction here will, I think, interest you. You will recall the fact that during the Spanish war Rear Admiral Remey served on board the *Lancaster*, a station ship at Key West. The Admiral was the center of communication between the Navy Department and our fleet in the West Indies. How well he performed that duty you need not be told. An officer of Admiral Remey's staff is quoted as having said of the work in the Admiral's office, that it "was exactly like the work during one of the War College war games; and that no study could have better fitted one for the real thing."

Were nothing else to be gained from a season spent at the

College, the participant in the game of war grows accustomed to approach a problem in maneuvers or strategy with some degree of confidence. He gains here, as he could nowhere else gain, a familiarity with many of the conditions of actual conflict. In other words, an emergency does not overwhelm him with surprise. More than this, the experience affords him an insight into what nine times out of ten the enemy is likely to do.

We may go a step farther and say that it is among the possibilities that some daring mind, kindled here with ambition to surpass his fellows, may one day conceive of an original idea in naval tactics, the realization of which will give to his country a tremendous advantage.

The United States in enlarging its borders and taking to itself foreign possessions has indeed assumed a grave responsibility. To the Navy is largely due their acquisition. Upon the people of these distant islands we are conferring the blessings of good government. For their protection and welfare we shall continue to look, in a large measure, to the Navy. Nor shall we be disappointed.

Never before in time of peace have there been held out to officers of the United States Navy opportunities so inviting to do good and lasting service to their country.

Let the standard of the Naval War College be maintained. Then, when war comes, and the people turn to their Navy, it will be with perfect confidence that its deeds shall deserve well of the Republic.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

EXPLANATION OF COURSE AT THE NAVAL WAR COLLEGE.*

JUNE 4, 1901.

By CAPT. F. E. CHADWICK, U. S. N., President of War College.

It is considered not out of place to say some words to those who have not been here before regarding the object of the College and its work, as there is not even among all of us in the service a clear understanding regarding these. It is necessary, in making an explanation of its purposes, to touch upon the study of the art of war in general, and say something of what has been done by other nations looking to the education of their officers and their preparation for war.

I think we may grant that war is the largest and most difficult business in which any one can engage. It is always the disruption to some degree, and sometimes in their entirety, of all our social forces and conditions, and a clearing of the way for their reconstruction. It is the letting loose of the social volcano, and the guidance of these gigantic forces is principally the province of the Admiral and the General. If study and experience are necessary in banking, in administering a governmental department, or a great system of railways, it is naturally the part of wisdom to suppose that they may be good, in fact, necessary, in this business of war, which is so much greater than any which can fall to our civilian brother. It would seem that the statement should be axiomatic, but the great mass of military men are unquestionably loth to accept it in practice. However willing they

* Opening address delivered by the President of War College, June 4, 1901.

may be, if pinned down to the point to admit the truth of what is just said, their habit, at least in general, is to allow it no weight whatever. We usually go on in the routine of the service, doing what comes to our hands to do, hoping that when the time comes to beat an enemy, we shall be ready and able to do so by the gift of God which comes to us by steady advancement through the grades of the service.

But all experience is against this; there have been certain great masters in our profession, some half-dozen of the foremost rank; and though we do not know overmuch of the views and habits of study of most, we know very thoroughly those of Napoleon, the greatest of them all; and no one can be more emphatic in regard to the value of the study of the work of those who had preceded him; and there is no question that he himself was a most diligent student, genius as he was. If such a man thinks study necessary, how much more needful is it for those who are not geniuses, and who must, therefore, depend upon the principles which govern our business. For there are such principles. War is not a haphazard game any more than the great game of commerce. It requires the study of conditions, means, appliances, and, above all, that study of lines and bases of operation which is known as strategy. The first complete and methodic dealing with this great subject was the epoch-making work of Jomini, which has become a classic and which, though it has had many successors, still stands in the front rank.

When we look over the field covered by the art of war, as tabulated by Jomini, I think there is no one who will say that there is no place or need in our profession for a college for the particular study of war as an art. He divides this into six distinct parts:—

1. Statesmanship in its relation to war.
2. Strategy, or the art of properly directing masses upon the theatre of war, either for defence or invasion.
3. Grand Tactics.
4. Logistics, or the art of moving armies.
5. Engineering—the attack and defence of fortifications.
6. Minor Tactics.

Though Jomini only touches upon maritime affairs "to be taken," as he says, "in connection with maxims of descents," his treatment of his main subject applies in principle to fleets as well

as armies. The fleet is simply an army moving with much greater rapidity than land forces. Its supply and maintenance involve the same considerations, and it is extraordinary that so great and original a mind as that of Jomini should not have grasped the more essential facts connected with command of the sea. It is the great pride of this College that it was the instrument of bringing before the world the views now accepted by all, of the overpowering influence of the army of the sea as contrasted with that of the army of the land. It was the great mind of Mahan which accomplished this revolution, giving sea power its logical supremacy in the minds of men which we can now all see it has always had in actuality. Had this College never had any further outcome; had it stopped with this result alone, its establishment would have been justified many times over. Mahan's work in giving naval power its just due has had a revolutionizing effect in international policies. It is not too much to say that no event in the latter half of the XIXth century did more to direct the world of statesmanship into new lines of thought than these great works of an officer of our Navy, and I do not think the weight which this College had in directing his own thought, and in the production of his great works which were first produced as lectures before the College, and as the natural outcome of his duties here, should be lost sight of.

Administrative reforms with us work slowly. The Naval Academy had to be forced upon the service. I myself was on duty there with an officer (and it was only twenty-six years ago) who, when he took up the duty of superintendent, was an utter disbeliever in its utility. I had this from his own lips, when he assured me, however, that he had now seen enough of it to change his mind. We have been more than a hundred years in bringing about the establishment in the Navy Department of a Bureau of Personnel, thus gathering into one section of the Department nearly, but not quite as yet, all things military, and we have been more than a hundred years in establishing a General Staff, which I hope is now accomplished in the triune organization of the General Board, the War College and the Intelligence Office. For the great province of this College is not so much in the work of the summer's course as its studies in General Staff work, with which, of course, the summer's work on the General Problem is in line.

Going back to Jomini's tabulation of the art of war into six parts, the first of these, it will be noted, is the great field of statesmanship, under which he brings, among other matters, military policy and military statistics and geography. Under the first-mentioned he embraces all the combinations of any projected war, except those relating to diplomacy and strategy, including the passions of the nation to be fought, its military system, its immediate means and reserves, financial resources, character of government, the characters and military abilities of the commanders of their armies, the influence of cabinet council or councils of war upon their operations, the system of war in favor with their staff, the military geography and statistics of the State to be invaded.

I would beg to recall how much we would have given in our own little war with Spain for thorough and accurate information regarding that which I have just quoted. There is no need to dwell upon the importance of such knowledge as an element of success No man can deal with war without feeling that, after ships and men, the one all-important thing is information, and no expense, no difficulty and, above all, no preliminary study should be spared to provide this.

While information is mainly the field of the Office of Intelligence, the remainder of Jomini's tabulation is largely the province of this College, covering a vast field of study, to much of which there is definite solution in any particular case.

An important field of work for the College is always that of battle tactics, to which we cannot give too much thought and study. The development of the musket and of field artillery; the development of heavy guns and of the torpedo have caused both armies and navies to go about their ends in a very different manner from that of fifty and one hundred years ago. The principles remain the same but the methods must differ, and the land and sea forces of the whole world are now studying this vital question. That it may take some time to develop these to perfection is not improbable, but we may hope that it will not take the centuries that were needed for the development of tactics under sail.

It may not be generally known that for a hundred years previous to the appearance of Clerk's work on Tactics in 1779, all actions between the French and the English were of a very indecisive character. Rodney made a first application of Clerk's prin-

ciples in his action with de Grasse. The final and successful tactics under sail were thus worked out in the solitude of a student's study, though there were hundreds of officers at sea to develop views, and scores of battleships with which to test them. This is an extraordinary fact and one which should not be lost sight of when the value of a place of study such as this is discussed; and I thus believe it is here where the question of tactics will be finally solved, because it will probably be here that some active-minded genius will have the time and opportunity for thought and study which one so rarely gets at sea. England, at the period of the publication of Clerk's tactics, had few officers who made an independent study of either tactics or strategy, and to this fact is clearly due a failure which made certain the loss to her of the American Colonies. Had Rodney not gone home on leave just at the time he did, it is beyond question that, with the opinion and views held by him, de Grasse would have failed to support Washington and Rochembeau; Cornwallis would have been relieved, the Yorktown expedition would have failed, and the consequences would probably have been fatal to the American cause. Rodney left orders covering the eventualities, but they were not obeyed. Admiral Graves, with faint conception of the enormous importance of his influence upon the situation, failed after his action with de Grasse to enter the Chesapeake, which, if he had done, would have prevented de Grasse from re-entering and would have prevented the reception by the allied forces of the siege train sent with the squadron of Barras from Newport. The result was one of the great turning points in the history of the world. This incident is mentioned merely as one of many to illustrate the fact that we cannot ignore preliminary study of strategic questions; that there must be a general study of these in order that we should not be at the mercy of chance as to whether the commander-in-chief has thought or not.

If we do not have this general study the chances are that he will not have thought, and even if he be a man such as Rodney, it is far better that he should have the aid of many minds instead of standing alone and unassisted. The united and long-continued study and thought of a large group of men are of more value than the off-hand thought of any one man of like mental calibre, and it is on this principle we have, in some countries at least, a general staff and places of study for such a staff akin in some degree to this.

I will supplement what I have just been saying here regarding the working out of the successful tactics of the last century in a student's study ashore, by quoting some of the remarks of the French Minister of Marine in introducing the bill in 1899, "establishing a school for advanced military and naval study." It was not the first effort of the French in this direction. Though the first report on the subject was submitted by the minister in 1882, the decree establishing the school was not issued until 1895, modified in 1896, again in 1898, and the new bill brought forward in 1899. M. Lockroy, in his explanation, appended the report of the Committee on Naval Affairs, in which occurs the following, which is apt to what has gone before. I quote:

"We beg leave to disagree at this point in order to refute, from now on, a theory which is in vogue and which seems to us dangerous—the theory which sets it forth as a principle that the fleet is the only proper school of tactics for the navy. The fleet is not a school, but a fighting force of the first rank, where each person is at his battle station, his mind absorbed by the heavy weight of his personal responsibility and the multifarious details of the duty with which he is charged. The fleet is no more a school than the sixth corps in the Vosges or the second division of cavalry at Luneville. Instruction is carried on there, to be sure, and professional knowledge increased, because at each step in the ladder of rank and command, the senior is the natural instructor of those who are under his immediate command; but this is done only according to strictly, one might say, officially defined lines, and beyond which it would be hazardous to authorize experiments, however instructive these might otherwise be. On each ship the divisional officer is at his guns, the torpedo officer at his torpedoes, and as we have stated in our general survey of the subject, it is attention to these details which, except when he is on watch, make up the officer's duty. It will be urged, no doubt, that officers should be informed of the scheme and purpose of each manœuvre, and that on the completion of the same these officers should be assembled by the admiral for the purpose of a general *critique*. Undoubtedly that is desirable; but how difficult to accomplish in practice! And, furthermore, would it not show a poor knowledge of human nature to fail to take into account the lack of interest of all persons in that which does not immediately concern themselves. At the most the

fleet is a school where the commander-in-chief and his personal staff may gain instruction."

I quote this to show that others are beginning to recognize what we expressed in the establishment of the War College.

The Germans have been the leaders in staff organizations, traces of which appear as early as 1655, and there were a very considerable body of officers doing staff duty as early as 1670. But the General Staff of to-day had its real start only in the beginning of the XIXth century, and its present basis dates only from 1821, when it was taken from under the Ministry of War and subordinated only to the commander-in-chief. Its numbers have gradually increased until, in 1898, were attached to it 229 officers, of whom twelve were General Officers. Within the General Staff is the Great General Staff of 123 officers, whose duty is wholly in the Great Staff building at Berlin, where they are entrusted, under the immediate direction of the Chief of Staff of the Army, with the preparation of plans of large military operations, with the collection of knowledge of and comparison of European military administrations and the study of the theatre of war; and, in addition, with the preparation of maps, the promotion of military history and, finally, with the training of young officers.

93 officers of the General Staff are with the troops to execute the measures inaugurated by the Great General Staff while obeying at the same time other (minor) orders of the general commanding the units of troops to which they are attached.

Appointments to the General Staff are through the War Academy, where 400 officers are maintained by the admission through competitive examination of from 100 to 150 yearly. These officers must have had at least three years service with the troops. They remain three years at the War Academy, being assigned three months in each summer while there to regimental duty, with another arm of the service than their own. The fourth summer is taken up by a General Staff journey. On graduation all return to their regiments until the following spring, when about twenty of the total are selected to take a probationary turn with the General Staff of from one to three years, at the end of which some are attached to the General Staff as full-fledged members, those unsuitable being returned to their regiments. A temporary return to regimental duty is, however, compulsory from time to time for all the General Staff officers.

The extraordinary care and time expended in the selection of these officers show the immense value set upon staff work by the German authorities. That it has had full fruition we all now know in the results of the campaigns of 1866 and 1870. The downfall of two great empires was the direct outcome of the thorough staff work of which at the time Moltke was, and had been from 1857, the head. In the face of the mighty results of the system it is vain to decry such studies. The other great military powers of Europe had, of course, some such organization, but none had the complete and flexible system of Germany. France began fair, but in 1832 the system of return of staff officers to the line was given up, and the staff naturally stiffened into the unwholesome and unprogressive routine inseparable from the continued occupancy of directive posts. There can be no surer road to inefficiency, not that it is down hill, but that it ceases to ascend, and we had the natural results when the two systems were pitted against each other in 1870. It will be seen that the Great General Staff covers the field which is now covered by our General Board, the Intelligence Office and the War College. These three organizations are thus closely interlaced, and as time goes on they will become more and more so. The partial separation is not at all a disadvantageous one, and, in fact, has many advantages. The Intelligence Office is our collector of information, very much of which does not apply to military study; the War College is the collator of such information on military subjects, whatever its origin, which has a bearing on questions of war. It is in nowise a teaching establishment in the ordinary sense of the term. It is a place for the study and discussion of military problems; for the study of war in all its phases, historical, strategical, tactical; of the events which lead up to war; of international situations, and of the probabilities or possibilities which might arise therefrom. Besides carrying on the study of such questions as continuously as its limited staff will allow, it prepares and lays before the General Board such studies as may be particularly called for. The aim, however, is to prepare, in connection with the General Board, studies for all eventualities, so that the Department may be able to furnish a commander-in-chief in war with complete studies of the theatre of war; with thought made to hand, so to speak, and enable him to act unhampered by the necessity of forming a judgment off-

hand regarding a great variety of questions on which hasty judgment cannot be safely made.

I should like to quote here some words of Admiral Taylor's taken from his "Memorandum on a General Staff for the Navy," which appeared in the PROCEEDINGS OF THE INSTITUTE of September last. After speaking of the real functions of the General Staff of an army or navy, he says:

"The second element, though rarely recognized in a formal manner, is by far the more important of the two. It is the mental training of officers engaged in this plan-making, and their consequent readiness to confront warlike situations in general. It does not equal the school of actual war, but it is only second to it—and there is no third method. This trained readiness of officers' minds, in the Franco-Prussian War of 1870, constituted the essential value of the diligent staff work done by the Germans during fifty years of peace. What the world at large saw were the plans of work perfected in all minutiæ, railroad cars numbered for special work, arriving near battlefields on schedule time, bringing guns or men, pontoons or hospital beds. This it was which, being so admitted, gave to the staff its reputation among non-professional people, and it was, in fact, a most valuable aid in the battle and campaign; but far greater, as a factor of efficiency, was the state of mind of German officers—from generals down to majors—that familiarity with war situations, acquired in the staff work of peace, which enabled them to confront all emergencies of the campaign with ready energy and composure of mind."

There are lectures during the summer course on various subjects which, though they may not in all cases be closely allied to the warlike side of our studies, are in the broad field of thought which staff studies must cover. Among these, and occupying a prominent place, are the lectures and studies in international law. This part of the course in this year will be dealt with, excepting in one instance of a short course of three lectures, by a more extended and thorough study of cases than has been attempted heretofore, in which I think all of us cannot help being interested.

From what has been said it will be seen that the attendance of officers during the summer is an adjunct only of the College work. We must naturally look forward to development upon the lines

which the long and successful experience of such a military expert among nations as is Germany has laid down for all of us. I may say that the Department has taken the first steps in obliging commanders-in-chief to send in lists of younger officers whom they consider particularly fitted for staff work. If we follow the natural trend of such training, these officers will be passed through terms of services at the War College and the Office of Naval Intelligence, so that in time the service will have a large body of men trained for such duties.

Events have forced upon us the necessity of a large navy. We cannot as a country lead the happy-go-lucky existence of the last century, when the world went its way thoughtless and careless of the United States. In all that period we emerged but three times from our attitude of exclusiveness in regard to international questions: once in 1823 in the Monroe Declaration; a second time in 1866 on the same principles in regard to France, and a third time in 1897 in regard to arbitration between Great Britain and Venezuela. Since then we have developed a great fleet, have stepped into a great international position, have extended through one hundred and eighty degrees of longitude or just half round the world, have become the greatest coal raiser and coal user, and, consequently, the greatest manufacturer. Such a position demands the best thought and the best judgment of the nation's directive forces, and it behooves us of the Navy to do our part in upholding the national credit by preparing, according to the best of our lights, for any part we may be called upon to play.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE NAVAL CAMPAIGN OF LISSA; ITS HISTORY, STRATEGY AND TACTICS.

By W. LAIRD CLOWES, Member of the United States Naval Institute.

The naval campaign of Lissa lasted for little more than a month; yet there is probably no naval campaign—certainly no modern one—of even ten times the length, which presents so many points of interest, so much suggestion, and so great variety to the student. Ironclads were in their infancy; for the Warrior had been less than six years afloat, and not five years had elapsed since the building of the Monitor. Both Italy and Austria, nevertheless, had already acquired a respectable squadron of armored vessels, and although many obsolete craft were also employed, the back-bone of the fighting force on each side was composed of ships which were then absolutely modern, in the sense that not one of them was five years old. Several of them, moreover, were good enough to have deserved a place in the fighting line of any first-class naval power of the time, and had been designed by the most reputable constructors, and built in famous French and British yards.

The brief campaign included not only a pitched fleet action, but also a certain amount of preliminary scouting, and a series of attacks upon forts, with an attempt at landing. Apart from all this, Lissa has the distinction of being the first battle between armored fleets in the open sea.

The commanders-in-chief on each side were notable personalities. Wilhelm von Tegetthoff, the son of an Austrian staff-officer, was born at Marburg, Styria, on December 23, 1827, and was educated at the Marburg Gymnasium and, from 1840

to 1845, at the College for Naval Cadets at Venice. In 1845, being then in his eighteenth year, he entered the Austrian Navy as naval cadet in the brig Montecuccoli, and later joined the corvette Adria. Obtaining a commission in 1848, he was appointed successively to several ships which served in 1848-49 in the blockade of Venice. In 1854, having continued in active service and attained lieutenant's rank, he was given command of the schooner Elisabeth, which cruised in the Levant, and, in 1855, of the steamer Taurus, which did police duty at the mouth of the Danube. In 1857, he accompanied Dr. Heuglin, the ornithologist, to the coasts of the Red Sea and the Gulf of Aden, and, in Somaliland, was taken prisoner and detained until a ransom was paid for him. While at Aden, he received news of his promotion to be Corvetten-Capitän, and, on his return in 1858, he was given command of the screw corvette Erzherzog Friedrich, in which he visited the coast of Morocco to enquire concerning some shipwrecked Austrian subjects. During the Franco-Italian War with Austria, he was assigned to the defense of the Venetian lagoons. He next became adjutant to the commanding admiral, the Archduke Ferdinand Max, whom he accompanied in the Elisabeth to Brazil. In April, 1860, he was made Fregatten-Capitän, or commander, and appointed to the screw frigate Radetzky in the Levant. In 1861 he was given the screw frigate Novara, and again sent to the Levant, this time as senior officer. In 1863 he turned over to the Schwarzenberg, and visited the Suez Canal works, but was recalled and ordered to the North Sea, where he fought the battle of Heligoland. He was subsequently made a rear-admiral. After the War of the Duchies he worked at Vienna at the reorganization of the navy, and also held command in the Mediterranean. Just before the war of 1866 he was about to take command of an expedition to Eastern Asia. After that war he travelled extensively; brought home in the Novara the body of the Emperor Maximilian, and served from 1868 as Chief of the Naval Section of the Austrian War Office. He died on April 7, 1871.

It is worthy of remark that von Tegetthoff won his great success when he was less than nine and thirty. Nelson was more than forty-seven at Trafalgar; Farragut was more than sixty-three at Mobile Bay; Duncan was sixty-six at Camperdown; and Howe was sixty-eight on the "Glorious First of June."

Von Tegetthoff's opponent was sixty when he was defeated at Lissa. Count Carlo Pellion di Persano was born at Vercelli, in Piedmont, in 1806, entered the Sardinian Navy in 1824, and attained the rank of captain in 1841. In command of the Daino, in the war of 1848-49, he distinguished himself. In 1851, in the Governolo, he took to England the Piedmontese exhibits for the exhibition of that year. During the operations of 1859, he commanded the Carlo Alberto, and was made a rear-admiral. He cooperated with Garibaldi on the coast of Sicily, directed the naval attack on Ancona, and received the sword of Lamoricière. For these services he was made a vice-admiral. In 1862 he was Minister of Marine, and, on retiring from politics, became an admiral. He had previously married an Englishwoman. After Lissa he was tried, and, on January 29, 1867, acquitted, on charges of cowardice and treason; but on April 15 following he was found guilty of negligence and incapacity, and was deprived of his rank, dismissed the service, and condemned to pay the costs of the trial. He died on July 28, 1883.

The authorities to which I am chiefly indebted for the following account of the campaign are:

a. The official despatches and ships' logs, Austrian and Italian.

b. "Der Kampf auf dem Adriatischen Meere im Jahre, 1866," published in 1869 by the Austrian General Staff, when von Tegetthoff was serving on it. For a copy of this I am beholden to the courtesy of the Marine Section of the Imperial and Royal Austrian-Hungarian War Ministry and to the personal kindness of Vice-Admiral Alexander Eberan von Eberhorst.

c. "L'Ammiraglio C. di Persano nella Campagna Navale dell' anno, 1866," published at Turin in 1873.

d. "Rendiconti delle Udienze Publiche dell Alta Corte di Guistizia nel Dibattimenti della Causa contra l'Ammiraglio Senatore Conte Carlo Pellion di Persano, precedentti dalla relazione della Commissione d'Instruttoria," published at Florence in 1867.

e. "Ancona e Lissa," the work of an Italian naval officer, who published it anonymously at Ancona in 1866.

f. "Relazione prima della Commissione d'Inchiesta sullo stato del materiale della Regia Marina," published at Florence and Genoa in 1867.

g. "Geschichte des Feldzuges, 1866, in Italien," by Capt. A. Hold; published at Vienna in 1867.

h. "Lissa." (*Revue des Deux Mondes*, November 1, 1866.) Attributed to the Prince de Joinville, who, however, denied the authorship.

i. A paper by Vice-Admiral Touchard in the *Revue Maritime et Coloniale* of 1866.

j. "Lessons from Lissa." A lecture delivered by the late Vice-Admiral Coomb on April 29, 1867.

k. An article in *Archiv für Seewesen* for 1866. Another in *Rivista Marittima* for January, 1869.

l. "Tegetthoff." By Prof. J. K. Laughton, R. N., in *Fraser's Magazine*, June, 1878.

m. Personal communications from officers, Austrian and Italian, who were present at the battle of Lissa. As several of these are of a confidential nature, I am precluded from giving the names of my informants.

I. Preliminary Movements of the Austrians.

1. Previous to the declaration of war on June 20, 1866, by Italy against Austria, hostilities by sea as well as by land had become almost inevitable, and Rear-Admiral Wilhelm von Tegetthoff, who had been placed in command of the imperial fleet, had made up his mind to neglect no opportunity for assuming the offensive. He lay in the roadstead of Fasana, Pola, with his force at anchor in four lines as follows:

FIRST LINE.	SECOND LINE.
Prinz Eugen,	Schwarzenberg,
Drache,	Donau,
Kaiser Max,	Adria,
Salamander,	Radetzky,
Don Juan,	Erzherzog Friedrich.
Erzherzog Ferdinand Max,	

THIRD LINE.	FOURTH LINE.
Hum,	Elisabeth,
Dalmat,	Greif,
Wall,	Stadium,
Velebich,	Andreas Hofer,
Reka,	Triest.
Streiter,	
Narenta,	

2. The armored frigate Habsburg, the screw line-of-battle ship Kaiser, the screw frigate Novara, the screw gunboat Seehund, the screw schooner Kerka, and the paddle-vessels Santa Lucia and Vulcan, had not then joined the flag. The Santa Lucia and Triest were, after the declaration of war, detailed to serve as despatch-boats for the maintenance of communication between Pola and the fleet, and took no other part in the operations of the war. Particulars of the remaining Austrian vessels, as well as of all the Italian ships that were actively engaged, will be found in the tables to be given hereafter.

3. On June 20, Rear-Admiral Tegetthoff ordered the Stadium to reconnoitre the Italian coast from Ancona to Bari; but she returned on the 23rd, unable to report that she had observed any concentration of the Italian naval forces. This induced the rear-admiral to quit Fasana, and to make observations for himself. On the 24th he shifted his flag from the Schwarzenberg to the ironclad Erzherzog Ferdinand Max, and telegraphed to the Archduke Albrecht, the supreme commander-in-chief, requesting to know whether the fleet might assume the offensive, or, at least, reconnoitre the Italian coast in force. It happened that the 24th was the day of Custozza, and that the Archduke, the victor in that action, was too much occupied to reply until the 26th. He then returned an answer to the effect that nothing stood in the way of the fleet's freedom of action within certain limits, but that operations must not be extended beyond Lissa, and that the mouth of the Po and the coast of Venice must be taken care of. In the interval the rear-admiral consulted with his captains and made provisional arrangements for operations against Ancona. The delay was not important, but it might have been so. In such a case, the command ought to be vested in the man on the spot. Austria possessed no second fleet with which it was necessary that von Tegetthoff should coordinate his movements.

4. Upon the receipt of the Archduke's reply, von Tegetthoff, who waited until the evening, sailed with the Erzherzog Ferdinand Max, Prinz Eugen, Kaiser Max, Don Juan, Drache, Salamander, Schwarzenberg, Hum, Streiter, Reka, Velebich, Elisabeth and Stadium, and appeared before Ancona at daybreak on the 27th. At about 3 A. M., the Elisabeth, which was scouting ahead of the fleet, sighted the Italian despatch-vessel Esploratore,

which was cruising before the port, opened fire on her, and, assisted by the Velebich and Reka, chased her in shore. All the other ships cleared for action, and, from 5.30 to 7.30 A. M., remained off the town at a distance of about two and a half miles. In the roadstead could be seen the Italian fleet, the greater part of which had left the Gulf of Taranto on the 22d, and reached Ancona on the 25th. Eleven ironclads, four frigates, and two despatch-vessels could be counted; and smoke from other funnels could be observed rising above the quay of the inner harbor. The Italians were quite unprepared for this exhibition of boldness on the part of the Austrians. Persano made a signal which was not generally understood by his captains, and which, had it been understood, could not have been generally obeyed, several ships not being ready.

5. Several of the Italian vessels got up steam, and two of the largest ironclads were put under way; but no craft ventured out, although the Austrians remained in the vicinity long enough to have enabled the Italians to challenge an action, had they been ready. The moral effect of this insult to a superior force by an inferior one was great on both sides.

6. The project of attacking an enemy of superior force, at anchor and protected by shore batteries, and possibly by mine-fields as well, did not recommend itself to the Austrian rear-admiral, who, therefore, at about 8 A. M., drew off to the westward, putting his wooden ships in the van. Before sunset he re-anchored off Fasana, where he found the Habsburg, which had arrived during his absence. Could Tegetthoff have induced the Italians to leave port, he would have given them battle, even on the 27th, when he was without the Habsburg, one of his two best ironclads; but he was too good a strategist to be willing to enter upon any operation which might weaken his own force without exposing the enemy's fleet in a corresponding degree. The Italian fleet was his first object throughout.

7. From that time, as there were rumors of an Italian descent upon Venice, all ships in port kept steam in half their boilers in readiness for immediate movement. On the 28th, towards sundown, Fort Brioni signaled that an ironclad, flying a tricolored flag, was in sight fifteen miles off. The Kaiser Max and Don Juan were ordered to proceed on reconnaissance, and they soon recognized the stranger as the British central-battery

armored sloop Enterprise, Commander Charles John Rowley, which was on her way from Ancona to Triest. On the 29th the Prinz Eugen proceeded to Malamocco (Venice), and, on the 30th, returned convoying a collier. On the same day a telegram, despatched by Field-Marshal-Lieutenant Baron Philipović, Statthalter of Dalmatia, informed von Tegetthoff that the Italian fleet was still at anchor in the roadstead of Ancona; that its force was stronger by four frigates than it had been observed to be upon the 27th; that it would probably be soon complete, and that, confident in its superiority, it would presently take offensive action.

8. The Austrians, after their return from before Ancona, made their final preparations for the struggle. All gear and stores that would be of no immediate value during an engagement were removed from the ships; the fleet pay-chest was divided among several vessels, and a new signal-book, which was to come into use on July 4, was perfected. The adoption of a new signal-book at the beginning of hostilities has disadvantages as well as advantages.

9. On July 4, von Tegetthoff was reinforced by the Novara, which, by dint of extraordinary hard work, had been refitted in an incredibly short time in Tonello's yard at Triest, and subsequently armed and manned at Pola. She had been seriously damaged by fire at Pola on May 3.

10. On July 6 the rear-admiral took his fleet to sea for exercise at steam tactics, and carried it within sight of Monte d'Ancona, but brought it back to Fasana after dark and re-anchored it. This brief cruise seems to have satisfied von Tegetthoff either that the Italians were still far from ready, and so could not leave port, or that they were inclined to neglect his fleet, and embark upon ulterior operations without having first reckoned with him.

11. On the 9th the rear-admiral summoned all his captains on board the flagship, and learnt their views as to the seaworthiness and general behavior of their vessels; and, on that and the two following days, fires were drawn, and the machinery and boilers of all the vessels were thoroughly cleaned. This, though a measure of wise precaution, might have been risky at such a moment, if the Italians had been ready and venturesome; but by that time von Tegetthoff had formed conclusions about the character of the Italian chief.

12. The Italians, in a manner which then appeared inexplicable, still delayed the commencement of their operations; and it was not until July 10th, on which day the arrival of the paddle-steamer Vulcan brought up the Austrian fleet to its intended strength, that news reached Fasana that about twenty hostile vessels were in sight twenty or twenty-five miles off Lissa, and that an Italian squadron of sixteen sail was off Isola Grossa. Von Tegetthoff could not then put to sea in force, owing to the orders relative to his machinery and boilers; nor did he want to. He desired, rather, to see the Italians commit themselves to some useless, inconclusive, and possibly damaging venture, and so lay themselves open to his onslaught under favorable conditions.

13. These movements led to no immediate results; and in the course of the 12th and 13th of July the Government of Dalmatia was enabled, by means of the Fiume, Venezia and Egitto, and of the Santa Lucia and Vulcan, which were lent from the fleet, to obey orders from the Minister of War to send to Triest four battalions from Sebenico, Lissa, Castelnuovo and Cattaro. The enemy did not attempt to interfere. Indeed, between the 14th and the 17th the Curtatone was allowed, without hindrance, to carry part of the Hohenlohe Infantry Regiment from Cattaro to Zara, and then to return to her station at Cattaro. Nothing could show more clearly the ineptitude of the Italians and the inefficiency of their scouting arrangements. They had cruisers enough, if not to stop all such movements, at least to report them. It seems that they were not observed at all.

14. On the 14th the British sloop Enterprise again passed and was sighted; and on the 15th, the Drache, which was cruising in the offing, observed the French armor-clad Provence, bound for Venice. It seemed as if the prospect of an action at sea was becoming remote. The mediation of France, on the basis of the transfer of Venice to Italy, had begun; and the presence of a French battleship which, according to an official intimation received in the fleet on the 11th, might be regarded as the precursor of a French squadron, seemed to indicate that the negotiations were moving to a conclusion.

15. Rear-Admiral von Tegetthoff was very anxious concerning the influence which the rumors of the surrender of Venice, and of the retirement of the Austrian Southern Army, might

have upon his men, eight hundred of whom came from Venice, and he begged the Minister of War, in case of the actual surrender of that city, to order the Venetian seamen to be sent ashore; but the answer that came back was: "Venice not yet given up; task of the squadron unchanged;" and this despatch, published as a fleet order, not only tranquillized the command, but also reassured those more energetic spirits who had begun to fear lest the navy might have no part in the campaign. Moreover, at about the same time there came from the southward news that the Italians seemed disposed to abandon their inactivity and to make a movement of some kind.

16. At last, on July 17, there reached the fleet at Fasana the following telegram from Lissa: "A man-of-war, under British colors, came in sight from the N. W., reconnoitred the island, and has drawn off to the S. E.;" and on the 18th, at 11 A. M., there arrived from the same place two despatches dated respectively 8.30 and 9.20. The first ran: "Nine ships-of-war, without colors, are about twenty miles off, and are approaching the island from the N. W.;" the second: "Ten war-steamers, fifteen miles off and under French colors, are approaching from the direction already signalled."

17. Rear-Admiral von Tegetthoff sent on these despatches to the Ministry of War at Vienna, and to Field-Marshal-Lieutenant Baron Maroičić at Görz, adding: "Think, therefore, should not go to the S. E., since this may be a demonstration of Italian ships to entice the squadron away from here. Beg, nevertheless, for intimation of views as to how squardon should act in face of such news. Salamander makes much water, and is obliged to go to Pola." Von Tegetthoff, who, I think, had previously made up his mind that the Italians meant to attack some part of the coast or islands, desired, apparently, that they should not attack Pola during his absence from his base, and that they should attack one of the numerous tempting points among the islands.

18. At about 2 P. M., other despatches came in from Lissa. One, sent off at 10.10 A. M., was: "Ships, already signalled, manœuvering N. W., colors down. Am preparing for action." A second, despatched at 11.45 A. M., was: "Ships already signalled approaching Lissa, distant ten miles." A third, despatched at 12.20 P. M., was: "Comisa attacked by twelve ships, Sardinian colors."

19. The last of these telegrams was forwarded to the Ministry of War by the rear-admiral with the addition: "I maintain my former view. Request orders, seeing that Lissa is very far removed from probable main point of attack." In other words, he could not then believe that the enemy would be so foolish as to risk himself against so unimportant a point. The idea seemed too good to be true. To the officer commanding at Lissa, von Tegetthoff telegraphed an inquiry as to the nature of the hostile vessels, in order that he might form an opinion about the real intention of the Italians. Soon afterwards there reached him the brief despatches: "Harbor of Lissa attacked" (12.40 P. M.), and "Hot artillery action at Lissa, without damage" (1.15 P. M.). Further telegrams, received in the course of the afternoon, gave a bald description of the progress of the engagement, and at 11 P. M. came the reply of the Commander-in-Chief of the Southern Army to von Tegetthoff's repeated enquiries as to what portion of the coast was, in the circumstances, to be most carefully guarded, and as to what was to be done to that end? The answer was: "Do not venture on any division of the squadron, and frustrate as far as possible every attack on the coasts of Istria and Triest." On the morning of the 19th, news arrived that the fighting at Lissa had been renewed; that the whole Italian fleet was engaged there, and that, therefore, no operations could be simultaneously intended against any other part of the coast.

20. Rear-Admiral von Tegetthoff thereupon determined to sail; to fall upon the enemy while thus engaged, and, incidentally of course, to carry out his orders by frustrating the attack on Lissa. He communicated his decision by telegraph to the Ministry of War and to the Commander-in-Chief of the Southern Army, asking for speedy replies; received his captains on board the flagship at 10.30 A. M., in order to make them acquainted with his plans, and at 10.45 A. M. signalled: "Light all fires," and "Ships that have steam will weigh." The Vulcan was directed to tow all lighters, etc., to Pola, and, with the Santa Lucia and Triest, to place herself at the disposal of the port authorities, who were to take measures for the shipping, as rapidly as possible, of 1000 tons of coal; and the Stadium took up a position under Fort Brioni, there to await the telegrams which were expected at 2 P. M., and to carry them to the fleet. Von Tegett-

hoff's anxiety with regard to coal contrasted strangely with Persano's short-sightedness with respect to this need of his ships.

21. A large number of the ships had already proceeded to sea when instructions reached the rear-admiral from the Ministry of War to act according to his own judgment, but not to go out in consequence of a mere demonstration against Lissa. It was no longer, as every despatch from the island proved, a question of a mere demonstration; and at noon the flagship quitted Fasana Roads. At 1.30 P. M. she had joined the rest of the fleet in the offing, and, a little later, amid the strains of the National Hymn and the thundering cheers of the ships' companies, who thronged the hammock-nettings and the shrouds, the Ferdinand Max took her place at the head of the line.

II. Preliminary Movements of the Italians.

22. Having now described the preliminary movements of the Austrians, I may fitly, before dealing with the attack on Lissa and the subsequent battle off that place, say something about the preliminary movements of the Italians.

23. The Italian Admiral, Count Carlo Pellion di Persano, who, as early as June 8 had, in view of the outbreak of hostilities, been ordered "to sweep the enemy from the Adriatic, and to attack and blockade them wherever he should find them," was, on June 20, telegraphically apprised by Signor Agostino Depretis, Minister of Marine, of the declaration of war, and directed without delay to proceed to Ancona with the ships (including nine ironclads) which were then at Taranto.

24. Persano, in consequence, quitted Taranto on June 22 with nineteen vessels, but as his slowest ship was not capable of a speed of more than five knots an hour, did not reach the harbor of Ancona until the 25th. On the same day he addressed to the Ministry of Marine a note on the wants of the fleet, particularly specifying telescopes, despatch-boats of greater speed than he possessed, as many Armstrong guns as possible, and more ironclads. The ministry complied in a few days with the most pressing and most readily granted of these requests, but declined the application, which, in view of the composition of the Austrian fleet, appeared to be somewhat unreasonable, for more ironclads.

Persano already had with him three more than von Tegetthoff, whose force practically represented the whole Austrian navy.

25. The departure from Taranto had interfered with the new arming of the ships, but this was resumed with great energy at Ancona, and the three ironclads, Re d'Italia, Palestro and Varese, were each supplied with two 150-pdr. (8-inch) Armstrongs.

26. On June 27, when the Austrian squadron appeared before Ancona, only one vessel was still engaged in changing her guns, but she, also finally took on board two weapons of the new pattern. The remaining craft were busy coaling, or were attending to the last of their repairs. The approach of the enemy was promptly remarked by the despatch-vessel Esploratore, Commander Cav. Orengo, and at 4 A. M. was signalled to the fleet.

27. Upon the admiral, who had gone on board the Esploratore, signalling "assetto di combattimento," all the ships prepared for action, and, in two hours, ten ironclads, four frigates, one screw corvette, one paddle corvette, three screw gunboats, and the paddle despatch-vessel were ready to engage. The ironclads Maria Pia, San Martino, Principe di Carignano and Castelfidardo, were the first to proceed into the roadstead, and later at the order of Admiral Persano, most of the others went in the direction of Monte Conero, two miles from the port, so as to take their places in line of battle under the protection of the shore batteries. This manœuvre gave the Austrian fleet time to withdraw absolutely unmolested by its greatly superior enemy. Persano's interpretation of the order to sweep the Austrians from the Adriatic, and to attack and blockade them wherever he should find them ought, I think, to have led to his instant supersession by Depretis.

28. At a conference held later on board the Principe di Carignano with Rear-Admiral Vacca, d'Amico, Chief of the General Staff, and Captains Jauch and Bucchia, Admiral Persano declared that he had not attacked the imperial fleet because three of his ironclads, the Re d'Italia, Re di Portogallo and Ancona, would not have been able to participate. Even without them, however, his force, especially in gun power, would have been vastly superior to that of von Tegetthoff. All his actions at the time tended to undermine the morale of his people, and the confidence of his officers in himself and themselves. Moreover, it was not a fact that the Re d'Italia and Re di Porto-

gallo could not have participated. He is also understood to have intimated that his instructions assigned to him more important operations—that he had orders not to risk the fleet—and that he looked for no advantage to result from following the foe. It is evident, not only that Persano misrepresented his intsructions, but also that he was so strategically blind, and so morally timid, if nothing worse, that he was practically paralyzed. It is known, too, that the reverses which had been already suffered by the Italians on shore had taken the heart out of him.

29. In his despatch to the Ministry of Marine, Persano put forward the necessitous condition of several ships as a reason for his inactivity on that day, but added that the fleet would be ready in a short time to attack the enemy, who, so soon as he had observed the formation of the Italian fleet, had taken to flight in the direction of Pola.

30. Although on the 28th of June it was reinforced by the screw frigate Vittorio Emmanuele, the screw corvette San Giovanni and the paddle despatch-boat Sirena, the Italian fleet remained for another ten days at anchor at Ancona, occupied solely in completing the equipment of the ships, and in putting itself into fighting order. Persano, unfortunately, had not the art, possessed in the highest degree by Saumarez and Nelson, of inspiring his people, and of getting good work out of them even on the darkest days. His example only increased their lack of confidence.

31. On July 5 France began diplomatic intervention, which the Italian Government, hesitatingly and without relaxation of hostilities, accepted. Impressed by the importance, at that junction of a decisive action, and prompted by the voice of the people, the Minister of Marine on July 5 telegraphed as follows to Admiral Persano: "The most serious considerations call for the hastening of the complete equipment of the fleet. I have despatched the Carlo Alberto, Principe Umberto (screw frigate), and Governolo (paddle corvette) from Naples, and ordered the immediate completion of the Affondatore. Inform me as to when the fleet will be ready to go to sea, and of what vessels it will consist." It should be explained that the Affondatore, lately built in England, had quitted Gibraltar on June 28 and proceeded with all possible speed to Naples.

32. A second telegram of the same day ran: "The proposals

of the Emperor of the French do not hinder the prosecution of hostilities; on the contrary, an action with definite result would be useful. The hastening of the equipment is pressing."

33. Thereupon Admiral Persano replied: "If the matter be pressing, the fleet is completely ready to put to sea; but two days are yet needed if the guns are to be embarked and the carriages fitted. The other needs are secondary. But I desire instructions, for I have none of any value except those of June 8." It might be thought that these were explicit enough and all-sufficing (see §23). Persano's telegram surely savored of impertinence.

34. Having received this message, the Minister of Marine, on the same day, telegraphed: "Let the fleet put to sea to-night, and do you await at sea those ships which are still engaged in getting their guns on board. Despatch is necessary."

35. The definite and specific instructions which had been asked for were thus given; yet, in spite of the urgent nature of the order and its precise wording, the fleet did not leave its anchorage. In a telegram of July 6 to the Minister of Marine, the admiral, while declaring that, except as regards the new guns, he was ready, requested more directions, using the following words: "I beg you to state definitely whether I am to attack the enemy should he be protected by fortresses. It would be better if the Affondatore were here; yet I will proceed without her. You know the situation, and will, therefore, be able to say whether an action will be sufficient, or whether a definite result is required." It is pitiful to find an officer, who was afterwards acquitted of cowardice and treason, shilly-shallying in this manner.

36. The Minister of Marine reiterated his urgent orders that the fleet should instantly leave the roadstead of Ancona, and repeated that it was important to fight the enemy and to beat him. To attack fortresses before the Austrian fleet should be defeated was not deemed to be desirable. Such an attack was indicated as an operation which, after a victory won, might be rendered advisable by circumstances, and by the results attained and to be attained. The strategy then outlined by Depretis was perfectly sound; but the judgment of a minister who could still continue Persano in command must have been at fault, and that it was so is shown by the minister's feeble change of strategy on July 15 (see §41).

37. The interchange of these despatches occupied three days; and still the fleet did not sail. On July 7 fresh orders arrived from the minister. These were to the effect that:

a. Persano was to seek the enemy, attack him in accordance with the instructions of June 8, and press the action to the utmost in order to secure a decisive result.

b. Should the enemy's fleet remain in Pola, or should it take refuge there, Persano should blockade Pola with an adequate force, but remain out of gunshot of Pola and of the works protecting the roads of Fasana.

c. The main object of the naval operation was, before all other things, to obtain command of the Adriatic, by freeing that sea from the Austrian fleet. Should Persano encounter that fleet, he was to follow it, attack it and beat it, or at least drive it into port, and there block it up in such a way as would prevent it from issuing forth again.

38. At length, at 4.30 P. M. on July 8, the fleet, with the exception of a few vessels which were still completing for sea and which remained behind under Rear-Admiral Provana, received the order to sail, not, however, that it might go in search of the enemy, although it is true that Admiral Persano specified this as the object of his operations. The fleet quitted the harbor at 6 P. M., and having arrived off the Gulf of Quarnero at 9 A. M. next day, returned again towards Ancona, so that by 2 P. M. it was about 40 miles to the S. E. of Monte Conero. This was the rendezvous that had been given to Rear-Admiral Provana. On the following day it stretched over towards the Dalmatian coast, approaching Isola Grossa and Lissa within about twenty-five miles, but then retiring again to sea, and exercising at steam tactics, signalling and gun-drill, yet not firing, in spite of the fact that many of the newly mounted guns had, of course, never been fired on board ship, and were strange to the people.

39. In this manner, distant alike from the coast of Italy and from that of Dalmatia, and as invisible to friend as to foe, the fleet manœuvred for three days on the line of 43° 11′ N. Having expended a great deal of coal, the loss of which could not be made good at sea, and not having sighted the coast of Venice or Istria, much less the enemy, it returned to Ancona early in the morning of July 13 and relapsed into its former inactivity regardless of the will of the Minister of Marine, who, foreseeing

that it must come back to replenish bunkers had, on the 10th and 11th of July, forwarded to Ancona two despatches, requiring Persano to fill up in the shortest possible time, to go to sea again and to carry out his instructions.

40. Admiral Persano evidently considered himself to be still too weak to attempt decisive action against the imperial fleet, and his three days' experimental cruise in the Adriatic seems to have convinced him that, before risking an engagement, further exercises were very necessary; nor can it be pretended that the Italian fleet, even at that period, was in the condition of perfection which, at the beginning of the mobilization, the Marine Ministry had considered it should attain ere it could successfully engage the Austrians. Persano was not the man to correct the shortcomings in discipline and training. On the other hand, the dockyard authorities, it must be admitted, were much to blame. The fleet was to have consisted of thirty-five vessels. Of its twelve ironclads, the Affondatore; of its heavy wooden vessels, the screw line-of-battle ship Re Galantuomo, the screw frigates Carlo Alberto and Principe Umberto, the paddle corvettes Governolo and Fulminante, and the screw corvettes Clotilde and Etna; and of its small craft, two despatch-vessels, one brigantine, and several transports, were absent. In fact, of the thirty-five men-of-war, inclusive of armed despatch-vessels, which had been intended to compose the active naval force, eleven were not upon the spot, so that on July 14 the fleet included only eleven ironclads, five screw frigates, one screw corvette, two paddle corvettes, three screw gunboats, and two despatch-vessels. Thus, leaving aside considerations of tonnage, engine-power, armor and armament, and looking merely at numbers, the Austrians were inferior as regards big ships, only by four ironclads and one heavy wooden vessel, and they actually had a superiority in the matter of gunboats. In other material respects, and particularly in gun-power, the Austrians were, it is true, at a great disadvantage; but Persano seems to have doubted whether (looking to the supposed probability that the enemy, if he fought at all, would fight in the neighborhood of a well-fortified harbor), all the superiority possessed by the Italians would justify them in hoping for a decisive result from an engagement. He judged von Tegetthoff by his own poor self. He therefore wished to await the arrival of a few more ves-

sels, and especially of the ram Affondatore. Nearly all his letters and despatches mentioned this ship, and urged the hastening of her junction with the fleet. The inactivity of the admiral was, nevertheless, so unwelcome to the people and the government, that the Minister of Marine deemed it wise to betake himself personally to Ancona in order to goad Persano to begin hostilities by means of a hint that otherwise he must be relieved of his command.

41. The Minister of Marine arrived on the morning of July 15, summoned d'Amico, the chief of the general staff of the fleet, and asked him whether he held that a sudden descent on Lissa offered prospects of success. D'Amico was of opinion that, as the conclusion of a truce seemed to be imminent, neither Venice nor Pola could be attacked; but that if it were required to deal some swift blow, no place was more suitable than Lissa as a scene of operations. Rear-Admiral Vacca, who was present, agreed with this opinion. A little later the project of a suitable descent on Lissa was put before Admiral Persano who, raising no objections, required only that a landing force of four or five thousand men should be placed at his disposal. Neither minister nor admiral seems to have raised a question as to the whereabouts of von Tegetthoff, or as to the probable attitude of his undefeated fleet. It seems to have been concluded that, because the Austrians had not attacked the Italians under the batteries of Ancona, they would not attack them anywhere. Indeed, Persano's feeble mind swung over readily from the extreme of moral timidity to the extreme of insensate rashness; and he finally went out on his mad expedition without an ounce of coal save what his ships had in their bunkers—coal, that is, sufficient only for four or five days' steaming—though he realized clearly enough that he was not in the least likely to capture Lissa in a day or to find any fuel there.

42. On the same day there arrived from the headquarters at Ferrara a memorandum by General La Marmora. This had been despatched by order of the king, and it admitted of no further postponement of operations. As the Minister of Marine undertook to strengthen the available landing force by 1500 men at once, and to send without delay further reinforcements of one battalion of marine infantry, two companies of engineers, and 1500 chasseurs, under the command of General Fontana,

Persano determined to sail on the following afternoon for an attack upon Lissa.

III. Lissa and its Defences.

43. Lissa is a mountainous island, forty miles from the Dalmatian mainland, and having between it and the mainland the islands of Lesina and Brazza. It is about eleven miles long from east to west, and six miles broad from north to south. The western extremity, splits into two promontories, between which lies the Bay of Comisa, with the town of Comisa at its head. Near the northeast extremity, at the head of Port St. Giorgio, lies the town of Lissa. At the southeast corner of the island is Porto Manego. The whole coast is much broken and lofty, and some of the interior peaks have an elevation of nearly 2000 feet.

44. The island was for some time, during the Napoleonic wars, occupied by the British, who fortified it, and when it was restored to Austria, the fortifications were repaired and improved.

45. Port St. Giorgio, which is about one and a half miles long and half a mile broad, runs inland in a westerly direction. On the north side the approach, at the beginning of 1866, was protected by Fort Georg and the smaller works, Battery Marmula, Robertson Tower, Battery Zupparina and Bentinck Tower, all of which stood on the small promontory which juts out between Port St. Giorgio and Porto Karober. On the south side, at the narrowest part of the entrance, stood Battery Schmid, with Wellington Tower above and behind it. At the head of the harbor was Battery Madonna. All the works, save Wellington Tower, which had fallen into decay, were in good order, though they were not modern, and had been constructed only to cope with wooden ships. In addition to them, upon the highest point of the road between Port St. Giorgio and Comisa was a work known as Fort Max.

46. Just before the outbreak of the war Bentinck Tower and its outlying defences were strengthened; Wellington Tower was repaired; Battery Magnaremi was erected on the north side of the mouth of the Bay of Comisa; a work was thrown up on Monte Perlić on the side of the same bay; two works were completed on the Vrani Kamić to dominate the N. W. corner of the island, and Battery Nadpostranje was built above Porto

Manego. Finally, above and behind Battery Madonna, at a height of about 800 feet, seven emplacements were made and armed on the hills of Andrea and Cosmo. The island was united by means of a telegraph cable with Lesina and Brazza, and could also communicate with those islands by means of optic telegraphs, or semaphores, placed on the peaks.

47. The various works which have been briefly catalogued were armed as follows:

	60-pdr. Mortar.	48-pdr. S. B. M.	30-pdr. Mortar.	30-pdr. Howitzer.	30-pdr. Shell Gun.	24-pdr. R. B. L.	24-pdr. M. L.	18-pdr. S. B.	12-pdr. R. B. L.	12-pdr. S. B. M.	10-pdr. Howitzer.	7-pdr. Field Howitzer.	7-pdr. Shell Gun.	6-pdr.
Fort Georg	2	6	1	..	..	4	..	4	..	..	..	..	..	..
Battery Mamula	..	..	1	4	..	2	..	..	..	..	..	..	..	..
Robertson Tower	..	..	..	..	..	..	..	..	1	..	..	..	..	..
Battery Zupparina	..	..	..	..	..	4	..	..	..	..	..	..	..	..
Bentinck Tower, etc.	..	..	..	2	..	..	..	..	1	4	..	..	..	..
Battery Schmid	..	2	..	..	..	2	..	..	..	..	..	..	..	..
Wellington Tower, etc.	2	..	2	..	..	..	..	..	..	..	1	1	..	..
Battery Madonna	..	..	..	..	4	4	..	..	..	..	..	..	..	..
Fort Max	..	..	..	..	..	..	2	..	..	..	..	..	2	..
Battery Magnaremi	..	..	..		..	4	..	..	4	..	..	..	..	..
Monte Perlič	..	..	..	..	..	..	..	..	..	..	..	..	..	2
Battery Nadpostranje	..	..	..	..	..	..	..	4	2	..	..	..	..	..
Cosmo-Andrea	..	..	..	..	..	..	..	4	..	..	..	..	..	4
Reserve, etc	..	..	..	..	..	..	..	..	..	2*	..	..	..	4*
	4	8	4	6	4	20	2	12	8	6	1	1	2	10

The Austrian pound equalled 1.2347 lb. avoirdupois.
*These were not guns, but 12-pdr. and 6-pdr. rocket-tubes.

48. The garrison of the island, after the transfer on the 12th or 13th of July of the 4th Jellačić Battalion to Triest, consisted of:

	Men.
5 Companies of Marine Infantry	1200
Company 3 of the Coast Artillery Regiment	297
Company 5 of the Coast Artillery Regiment	265
Engineers	27
Seamen	44
	1833

The whole was under the command of Colonel Baron Urs de Margina, who also had at his disposal in Port St. Giorgio the steamer Egitto, which, however, was unarmed.

* * * * *

On July 16 the Italian fleet left Ancona for Lissa. It then consisted of the eleven ironclads Re d'Italia (flag), Re di Portogallo, Principe Carignano, Maria Pia, Castelfidardo, Ancona, San Martino, Formidabile, Terribile, Palestro and Varese; the four screw frigates Maria Adelaide, Gaeta, Duca di Genova and Vittorio Emanuele; the three corvettes Guiscardo and Ettore Fieramosca (paddle) and San Giovanni (screw); the two armed despatch-vessels Messaggiere and Esploratore; the two hired despatch-vessels Flavio Gioia and Stella d'Italia; the Washington, hospital-ship, and the Indipendenza, store-ship. Later in the day, the three screw gunboats Montebello, Vinzaglio and Confienza, and the unarmed despatch-vessel Giglio joined. The screw frigate Garibaldi, which had remained behind to attend to her machinery, picked the fleet up on the 18th, and the long-desired ram Affondatore reinforced Admiral Persano on the 19th.

IV. The Italian Attack on Lissa.

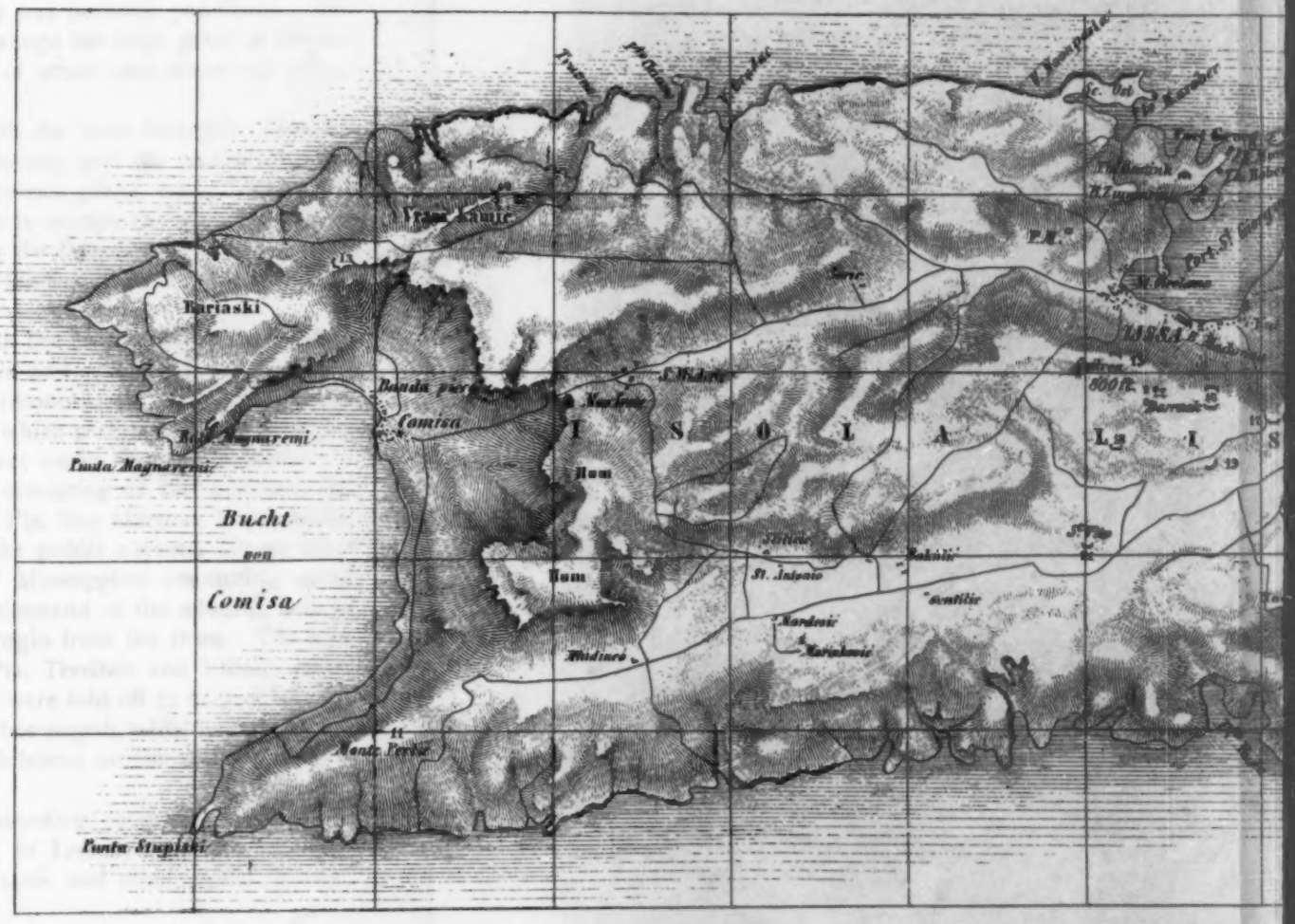
49. As the fleet was without a trustworthy chart of Lissa, for which the commander-in-chief had applied in vain to the Ministry, Captain d'Amico, the chief of the general staff, was sent on board the Messaggiere to undertake a reconnaissance.

50. In order to conceal its real object, the fleet headed until nightfall for the island of Lussin in the Gulf of Quarnero, but on the 17th altered course, and on the 18th, at 8.30 A. M., appeared for the first time in sight from the island of Lissa, distant about twenty miles to the N. W. In the meantime, on the 17th, at sunset, the Messaggiere which, under British colors (see §16), had cruised round the island, had rejoined the flag, and Captain d'Amico had given the admiral a tolerably correct, though somewhat general, account of the works on shore. These he had sketched in on a previously prepared map, and he had reported that, according to his estimate, they were held by about 2500 men. It does not appear that the Italians had satisfied themselves as to the whereabouts of von Tegetthoff.

51. Persano, who had originally intended to appear with the bulk of his fleet before St. Giorgio, and, while he attacked the harbor, to disembark his troops at Comisa, and to march them thence so as to take the St. Giorgio defences in the rear, now realized that a landing at Comisa would inevitably meet

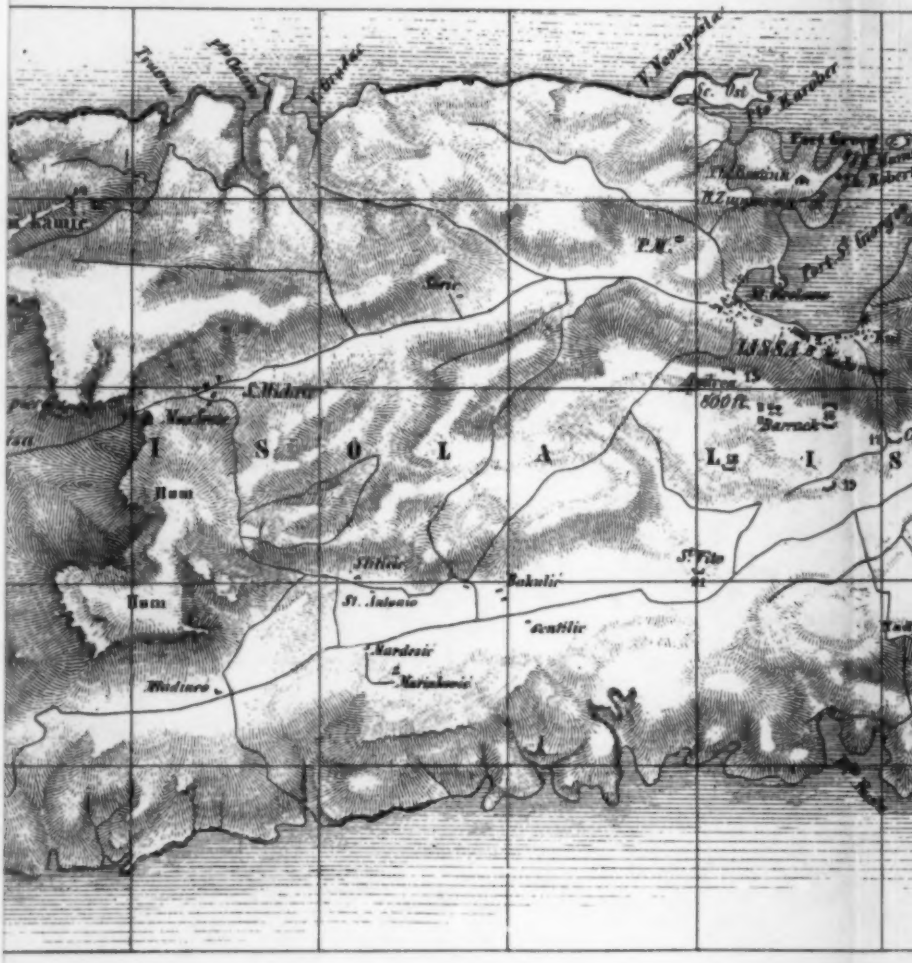
MAP OF THE ISLAND OF LISSA.

Showing the Fortifications at the time of the Italian Siege, July 18 and


Canale di
Lussin
Lussin Piccolo
Ilovik
Unie
Premuda
Susak
Vrtlenik
Ist. Ost
Port Carober
Port St. Giorgio
Port St. Giorgio
Port St. Giorgio

MAP OF THE ISLAND OF LISSA.

Showing the Fortifications at the time of the Italian Siege, July 18 and 1



SCALE—1 SQ. INCH = 1000 SQ. METRES.

0 1 2 3 4 500 1000 2000 3000 4000 Ft

I. Lesina

From Der Kampf auf dem Adriatischen Meere im Jahre 1866.
Wien, 1869, *Verlag des k. k. Generalstaben in Comm. bei C. Gerold u. Sohn.*

1000 Klftr.

with difficulties. He did not, however, regard the island as a Gibraltar. On the contrary, he considered that, though the operation might take time, and might not perhaps be completed until after the arrival of the promised reinforcements for landing purposes, the capture of the place was perfectly practicable. But as he now purposed to make Manego his chief point of disembarkation, he modified his plan of attack and made his dispositions as follows:

52. *a.* Rear-Admiral Vacca, with the three ironclads, Principe Carignano, Castelfidardo and Ancona, and the paddle corvette Guiscardo (mounting in all eighty-two guns), was to attack the works in the bay of Comisa, so as to occupy the attention of part of the garrison, and, by reducing the batteries, to afford the expeditionary corps a possibility of landing there in case a landing should not be effected elsewhere.

53. *b.* Vice-Admiral Albini, with the four screw frigates Maria Adelaide, Gaeta, Duca di Genova and Vittorio Emanuele, and the screw corvette San Giovanni (mounting in all 206 guns), was to silence Battery Nadpostranje, which protected Porto Manego, and then disembark a landing force under Captain di Monale.

54. *c.* The bulk of the fleet, consisting of the ironclads Re d'Italia, Re di Portogallo, Maria Pia, San Martino, Formidabile, Terribile, Varese and Palestro, the paddle corvette Ettore Fieramosca, and the despatch-vessel Messaggiere (mounting in all 173 guns), under the personal command of the admiral, was to attack the works of Port St. Giorgio from the front. The four ships Re di Portogallo, Maria Pia, Terribile and Varese, under Captain Ribotti, as senior officer, were told off to the defences on the south and east side of the harbor mouth, while the rest, under Persano, were assigned to the defences on the north and west side.

55. *d.* The gunboat flotilla (mounting 12 guns), under Commander Sandri, was to proceed to Lesina, there cut the submarine cable, and destroy all vessels, and other means of communication with the mainland.

56. *e.* The Esploratore was to cruise between Punta Planca (called in many charts, Punta Blanca, on the mainland) and the island of St. Andrea, and the Stella d'Italia between St. Andrea and the island of Pelagosa, and to signal any approach of hostile ships. By this arrangement Lissa was placed about 20 miles

inside the point of a right angle formed by the lines upon which the two vessels were instructed to cruise.

57. *f*. The Indipendenza and Washington were to lie off the island of Busi, about five miles to the southwest of the island of Lissa and to await orders.

58. These dispositions were to have taken effect at daybreak on the 18th, but owing to various reasons, it was not until between 10 and 11 A. M. that the vessels began to reach their stations.

[In my humble opinion, the plan, apart from the damning defects of the main strategy which allowed of its being employed at all, was not a sound one. Persano's idea was, with his ships, to occupy attention at two distant points while a landing was being effected at a third and intermediate point. Ships do not necessarily occupy much of the attention of the garrisons of forts of elevated command. The forts may wholly or partially neglect the ships, especially if there be no good landing place near. But an attempted landing is a real threat. Persano, therefore, should have concentrated his heavy ships and divided his landing parties. Such was the plan which was adopted with conspicuous success more than once by the Japanese in their war with China in 1894-5. Moreover, Persano ought to have known the futility of expecting ships to deal successfully with works perched far above them.]

59. Reinforced by the Garibaldi, which had joined at 9 A. M., and which was assigned to Albini's division, the fleet approached the island. The garrison had been forewarned by the Messaggiere's reconnaissance on the morning of the 17th that something was intended against it, and a good lookout being kept, the telegraph station on Monte Hum was able, soon after sunrise, to signal that nine men-of-war, distant twenty miles and flying no colors, were steering a N. E. course towards Lissa (see §16). Little by little more ships were sighted, until twenty-two were counted. At 9 A. M. they were visible from Battery Magnaremi, near Comisa, and at 11 A. M. Ribotti's four ironclads, coming from the S. W., approached within gunshot. Magnaremi opened promptly, and all the ships at once hoisted Italian colors and dressed themselves with flags. The four ironclads took station to the N. W. of the battery and opened fire upon its right flank, which contained the powder-magazine. Magnaremi at first

replied with the three rifled 24-pdrs. of the flank attacked, but to strengthen the fire, the commanding officer caused the guns from the left flank to be run across and fought over the top of the magazine. The enemy, surprised by the increased fire, altered his position. At the same time, Vice-Admiral Albini's wooden ships appeared, took station in front, and on the left flank, of the battery, and engaged. Soon afterwards Rear-Admiral Vacca's ships also joined in the action.

60. Magnaremi, thus for a short time assailed by fourteen ships, behaved very creditably, and never slackened its fire; but the Italians had great difficulties to contend with, for the battery was not only small, but also about 500 feet above the sea-level. At first the projectiles did not reach the height; later they overshot it. Only two in all struck the scarp of the work. Whenever any ship moved within range of them, the two 6-pdr. La Hitte guns, posted 800 feet high on Monte Perlić, were fired; but it cannot be supposed that such little weapons did much harm.

61. After the arrival of the division of Rear-Admiral Vacca, who thenceforward took charge of the action at Comisa, Albini and Ribotti drew their ships out of fire, and steered along the southern shore of the island, the former for Porto Manego, and the latter for St. Giorgio. Admiral Persano, with his ships, seems to have proceeded to St. Giorgio by way of the northern side of the island. At 11 A. M. Ribotti's division, in column of line ahead, passed Manego, and, when Battery Nadpostranje fired a blank charge, the three leading vessels altered course to starboard and made a wide bend which took them out of gunshot. The fourth vessel drew nearer, and two shotted rounds were discharged at her, but failed to hit her. Thereupon she also, without making any reply, kept away and followed her consorts around the eastern side of the island.

62. A little later Vice-Admiral Albini's wooden ships appeared before Porto Manego and took station opposite Battery Nadpostranje. The Maria Adelaide and Vittorio Emanuele approached within range and opened with their heaviest guns, but failed to reach the work, which lay about 500 feet above the sea. Nadpostranje replied with twenty-eight rounds, which killed two and wounded three people on board the Maria Adelaide.

63. In the meantime, arriving from the westward, the first of Persano's iron-clads approached within range of Fort Georg at about 11 A. M. Fired at by that work, they passed it without replying, but presently stationed themselves in such a manner as almost to surround the fort and began a furious action, in which Ribotti's division, coming in from the eastward and taking position opposite Wellington Tower and Battery Schmid, soon joined. While the ironclads, kept in continual motion, rained heavy projectiles on the forts, the latter returned the fire with steadiness. Aware of the small size of the guns on shore, the enemy often ventured within 1500 yards of the defences. The flagship Re d'Italia, at length placed herself within 500 yards of Battery Schmid, which, only forty feet above the sea, tried in vain to drive off its formidable opponent, and, at about 2 P. M., Battery Schmid's magazine blew up, burying forty men in its ruins. It was the Italian flagship that, by a fortunate shot, had wrought this damage, and cheers from all the ships greeted the success. Soon after the explosion in Battery Schmid, several small magazines blew up in Fort Georg, and Batteries Mamula and Zupparina, and, especially at Fort Georg, occasioned much loss; but nowhere did the defence lose heart, and a continuous fire was kept up. Wellington Tower was particularly active, and Admiral Persano therefore ordered the Maria Pia, San Martino and Formidabile to draw nearer to it and to bombard it as hotly as possible.

64. While eight ironclads were thus engaged in endeavoring to silence the defences of Port St. Giorgio, the paddle corvette Guiscardo arrived from Comisa with a message from Rear-Admiral Vacca to the effect that, owing to the inaccessible elevation of the Austrian works there, he had ceased to bombard them and was on his way to Porto Manego, where he purposed to support Vice-Admiral Albini. Vacct had, in fact, suspended his bombardment at 1 P. M. When he arrived off Manego, he discovered that Albini was inactive for reasons similar to those which had operated at Comisa.

65. A council of war, assembled in Albini's flagship, the Maria Adelaide, had already unanimously recognized the uselessness of continuing an engagement which, while it involved loss and damage to the wooden ships, seemed to promise no result, and it was in doubt as to the advisability of attempting to land troops.

Vice-Admiral Albini despatched the screw corvette San Giovanni with this intelligence to Admiral Persano, from whom he requested further orders. Vacca, informed of the condition of affairs at Manego, steamed on with his division for Port St. Giorgio.

66. Admiral Persano was in no small degree surprised at the resultless nature of the operations of his subordinates, and made a communication in writing to that effect to Vice-Admiral Albini. This was, perhaps, natural, for it is difficult to imagine that the small and loftily placed works dominating the south coast of the island could have been of sufficient force to prevent a seriously attempted landing of troops, or to bar their advance towards Lissa. It is disappointing, too, to any commander-in-chief that subordinates, instead of sending for fresh orders, should, on their own responsibility, abandon the positions and duties assigned to them.

67. At the same time Persano sent orders to Albini to join the main ironclad division, and to Vacca, to keep at least one ironclad before Comisa in order to hold the local garrison in check. Shortly after the despatch had been sent off to him, however, Vacca appeared off St. Giorgio, and Persano then instructed him to direct the fire of his division simultaneously against Wellington Tower and the inner defences of the harbor. About half an hour later, Albini's division also joined the fleet, and was ordered to effect a landing in Porto Karober, which lay close at hand.

68. While Albini made the necessary preparations to this end, every ship concentrated the greater part of her fire on Battery Madonna, Wellington Tower and Fort Georg, which, not having been built to withstand such a storm of projectiles, suffered severely.

69. In the meantime Albini's vessels, covered by the projecting peninsula known as Scoglio Ost, took station off Novaposta in such a manner as to expose themselves as little as possible to the guns on the weak left face of Fort Georg. At 5 P. M., the fort which, during a six hours' action, had lost one-fifth of its garrison, had had half its guns dismounted, and had been, in places, razed level with the ground, and which, at the last, had to contend with no fewer than 433 guns, ceased firing. Battery Mamula, which lay beneath the fort, and was exposed to the

same destructive hail, lost its commandant, Gomola, and a third of its garrison, and was silenced soon after Fort Georg had become quiet.

70. The Italians quickly perceived the effect of their fire and unwisely resolved to force the harbor. In view of the fact that a landing had been ordered at Karober, there was no reason for attempting to do all the work with the ships. The Formidabile was ordered to plant herself in the entrance, and the Maria Pia and San Martino were directed to proceed into the bay and engage the batteries there. Some of the remaining ironclads approached the mouth of the port, and, with the paddle vessels, which up to that period had been kept at a distance but were now brought nearer, were instructed to throw their heaviest projectiles up the harbor, while the Re d'Italia placed herself in front of the still almost undamaged Battery Zupparina.

71. Suported by the fire of these craft, the Formidabile, followed by the Maria Pia and the San Martino, moved slowly and cautiously into the bay under the guns of Wellington Tower of Bentinck Tower, and, more effective than all, of Battery Zupparina, which, paying no attention to the other vessels, concentrated all her guns upon the ships that were on their way in. Arriving opposite Zupparina, the three iron-clads discharged their broadsides at the battery, which, however, at a distance of barely one cable, continued steadily to direct her projectiles at their ports, and thus managed to get a 24-lb. shell into the interior of the Formidabile, the leader of the line. Intimidated, perhaps, by the resultant explosion, the Formidabile suspended her advance, and as the hitherto untouched Battery Madonna at that moment joined in the action, the three ironclads, which had already passed the line between Battery Zupparina and Battery Schmid, began to haul off.

72. When the enemy made this mad and unnecessary attempt, the hired Austrian Lloyd steamer Egitto, which had been placed under the orders of the commander of the island, and which seemed to be threatened, was sunk in shallow water up to the level of her upper deck, and the troops, which had until then occupied the hamlet of Lissa, were withdrawn to the heights of Andrea and Cosmo, while all the available field-guns were put in position behind the emplacements on these heights with a view to the support of Battery Madonna.

73. Hitherto the cable to Zara had been in working order, and, by means of it, all occurrences had been reported; but after the despatch of the message announcing the catastrophe at Battery Schmid, the wire suddenly became useless. The explanation is that at 4 P. M. a gunboat belonging to Commander Sandri's flotilla (see §55) had entered the harbor of Lesina, had taken the harbor officials on board, and, by threatening to bombard the town, had induced the local authorities to discover the position of the cable, which had been then cut.

74. After the failure of the attempt to force the port, it seemed to the Austrians as if the enemy determined to destroy Wellington Tower, so as to complete the silencing on that day of the outer defences, even if the inner ones could not be reached. At 6 P. M. all the ironclads were concentrating their fire upon the tower, which, together with the adjoining mortar battery, 600 feet above the sea, was exposed to a close bombardment for two hours. The defence was assisted by Bentinck Tower, and also by Battery Zupparina, whenever any vessels showed themselves within range of the guns of that work. Wellington and the mortar battery replied as warmly as they could to the enemy's more numerous projectiles, many of which flew far over the tower, and, falling, set the hillside undergrowth in flames.

75. It was after 7 P. M. when Admiral Persano, realizing the necessity of giving his men some rest, collected the greater part of his fleet in line, out of gunshot, to the north of the harbor. For a time he left Vacca's division before Wellington, which, on the north side, had been somewhat seriously breached, and the safety of which was thus imperilled. Nevertheless, the howitzers on the summit of the tower, and the mortars below it, were still firing when, at about eight o'clock, Vacca's division drew off, and with the rest of the fleet, dropped anchor after sundown eight miles to the northward of the coast.

76. At 10 P. M. the gunboat flotilla from Lesina rejoined the flag, and Commander Sandri reported to the admiral that, shortly before the cable had been cut, a despatch had gone through to the effect that the Austrian fleet might be expected off Lissa. This news, which Commander Sandri declared that he had obtained from an Austrian official, appeared to Admiral Persano to have been invented in order to deter him from prosecuting his attack upon the island, and he decided that, on the following

day, the 19th, although he would keep the greater part of his fleet ready to ward off any Austrian interference that might be attempted, he would resume the engagement with the works on shore, and would again endeavor to effect a landing in Porto Karober. It is clear, I think, that Persano was not a student of naval history. Had he been one, the mere fact of Lissa being near him must have recalled to him how narrowly Dubourdieu, in 1810, had escaped being caught by Hoste at a disadvantage while in the act of seizing part of the island. It would also have reminded him that Dubourdieu, in 1811, sailed from Ancona to capture Lissa without having first reckoned with the undefeated British squadron in the neighboring waters, and that, in consequence, he was disgracefully beaten by Hoste with a very inferior squadron. History sometimes repeats itself with startling simplicity. The officers commanding the landing force, the artillery and the engineers, were summoned on board the flagship and agreed with Persano's decision; but they expressed some doubt as to the success of the undertaking until reinforcements should arrive. The paddle-corvette, Ettore Fieramosca, with despatches concerning the day's work, was sent from the fleet, and in the dead of night some other vessel appears to have approached the Bay of Stončica in order to reconnoitre, for at 12 o'clock Wellington suddenly fired a shot in that direction, disturbing the numerous working parties that were repairing the sorely damaged defences. But if a ship did indeed approach, she quickly retired again, and from midnight until morning there was no further alarm.

77. During the hours of darkness Admiral Persano's timidity and infirmity of purpose tormented him with doubts whether, after all, his available troops, which all his advisers believed to be insufficient for the business, ought to be landed on the little known territory of the enemy, and finally he came to the conclusion that he would await reinforcements. On the morning of the 19th, however, he ordered Vice-Admiral Albini and Rear-Admiral Vacca to proceed with the bombardment of the works, pending the time when a landing could be made. Already he had expended a large quantity of ammunition, only to discover that the Austrians repaired damages quickly. He was now about to expend more, although he had no means of knowing when he would be able to recoup himself, or that he would be

in condition to profit by the expenditure ere the defenders should again patch up their works. Unless a bombardment be designed to be merely punitive or destructive, it should not be carried out until circumstances permit of its being instantly followed up.

78. At 7 A. M. on the 19th, the divisions of Albini and Vacca again approached Port St. Giorgio and bombarded Fort Georg and the works near it, Albini firing, merely for practice, at Wellington Tower also. Fort Georg, Robertson Tower, Battery Mamula and Wellington Tower, with its mortar battery, returned a few shots. The reply from Bentinck Tower and Battery Zupparina was more vigorous. At about 8 A. M. the Italians discontinued the bombardment. The ironclads steamed to the N. W.; the wooden ships proceeded along the coast towards Comisa. The latter, however, again approached St. Giorgio at 9.30 A. M., and from a position off Novaposta, opened against the left face of Fort Georg, the reserve magazine of which, containing about 55 tons of powder, was very ill protected, and was in great danger. Happily for the Austrians, the firing soon slackened again, until at 11 A. M. no great damage having in the meanwhile been done, all the vessels withdrew far out of range.

79. Shortly before that hour the expected vessels, the screw frigate Principe Umberto, with 125 men of the Marine Infantry on board, the screw frigate Carlo Alberto, and the paddle-corvette Governolo, had arrived. A little later came the ironclad turret-ram, Affondatore.

80. The reinforcements brought by these ships raised the strength of the landing party to 2600 men, and Admiral Persano, who no longer had any doubts as to the result, and who did not consider himself to be condemned to inaction or even to special caution, by any vague apprehension, founded upon mere hearsay report, that the Austrian fleet might appear, thought that the time had come to renew the attack, and, partly by heavy gunfire, partly by disembarking a strong force, to make himself master of the island.

81. He ordered, in consequence, the following arrangements:

a. The unarmored squadron, consisting of seven frigates and four corvettes, supported by the four gunboats, and commanded by Vice-Admiral Albini, was to land the troops at once in Porto Karober.

b. The iron-clads Terribile and Varese were to proceed to Comisa and to occupy the attention of the garrisons of the batteries there.

c. The Formidabile was to enter the harbor of St. Giorgio and to silence such batteries there as were still capable of fighting.

d. Rear-Admiral Vacca was to support the attack of the Formidabile with the ironclads Principe Carignano, Castelfidardo and Ancona.

e. The ironclads Re di Portogallo and Palestro were to attack Wellington Tower with their 300-pdr. and 150-pdr. guns.

f. The Re d'Italia, San Martino and Maria Pia, under the immediate orders of the commander-in-chief, were to hinder any attempts on the part of the works on the N. W. to interfere with the landing at Karober.

82. At 4.30 P. M. the Italian fleet approached the island, and again began to engage the works at Comisa and about Port St. Giorgio. At Comisa, the Terribile and Varese opened fire against the northern face of Battery Magnaremi. Presently two more ironclads probably the Re di Portogallo and Palestro, which had been assigned to the attack on Wellington Tower, arrived, and, after 6 P. M., these were joined by six wooden ships of Albini's division. While the ironclads aimed at the battery, the wooden ships directed their fire up the bay; but the good practice of the battery and guns on Monte Perlić kept at a distance the wooden craft, the projectiles from which did not reach the shore. As on the previous day, the engagement was a resultless cannonade.

83. After half an hour's firing, Albini's six vessels and two ironclads steamed off to Karober, leaving at Comisa only the Terribile and Varese, which prolonged the useless bombardment for another two hours.

84. Neither Magnaremi nor the guns on Monte Perlić received any considerable damage, and the obvious impotence of the enemy at Comisa enabled the greater part of the Marine Infantry there to be detached to Fort Georg and Bentinck Tower. Only an officer and forty men remained to take care of the guns on Monte Perlić.

85. More serious and bloodier work was being done in Port St. Giorgio. Soon after 4.30 P. M., the Formidabile began to discharge broadsides at Fort Georg, and, firing continuously, she gallantly went on until she was distant but a cable and a half

from Battery Mamula. For her support Admiral Persano ordered the Affondatore to fire her 300-pounders up the harbor, and at 5 P. M. the admiral, with the ironclads Re d'Italia, San Martino and Maria Pia, took the station which had been occupied by the Formidabile, and got into hot action with Bentinck, Wellington and Zupparina. At 5.30 P. M. such of Albini's wooden ships as were off Karober also engaged, and again imperilled the reserve magazine of Fort Georg and the rear of Battery Mamula. From time to time they also sent shots into the rear of Battery Zupparina and into the valley of Somogor, where a large powder magazine had a very narrow escape from destruction, several shells falling close to it, but not bursting. Wellington, which uninterruptedly threw shells at the ships, was little damaged, but most of the other works suffered severely.

86. By this time the Italians, in addition to having destroyed Battery Schmid on the previous day, had silenced every gun in the northwestern group of works comprising Fort Georg, Battery Mamula Robertson and Bentinck Towers and Battery Zupparina, except a 30-pdr. coast howitzer in the battery at the foot of Bentinck, and three 24-pdr. breech-loaders at Zupparina, and were entitled to expect that, if their ironclads could destroy Battery Madonna at the head of the harbor, and if the troops could be disembarked at Karober and could attack the defences of St. Giorgio in the rear, the island would be won. While, therefore, the squadron redoubled its fire, and the flagship placed herself opposite Battery Zupparina and endeavored to crush it by repeated broadsides, the Formidabile, supported, but at a distance of two miles by Vacca's ships, the Principe Carignano, Castelfidardo and Ancona, made for the center of the bay.

87. The garrison hastily placed its reserve artillery (in the shape of a few guns from the more remote emplacements) as near as possible to the harbor, and the 10th Company of Marine Infantry lined the slope on each side of Battery Madonna, and occupied the rows of houses at Kut, immediately to the right, for the advancing vessels this time showed no hesitation, but a full determination to succeed.

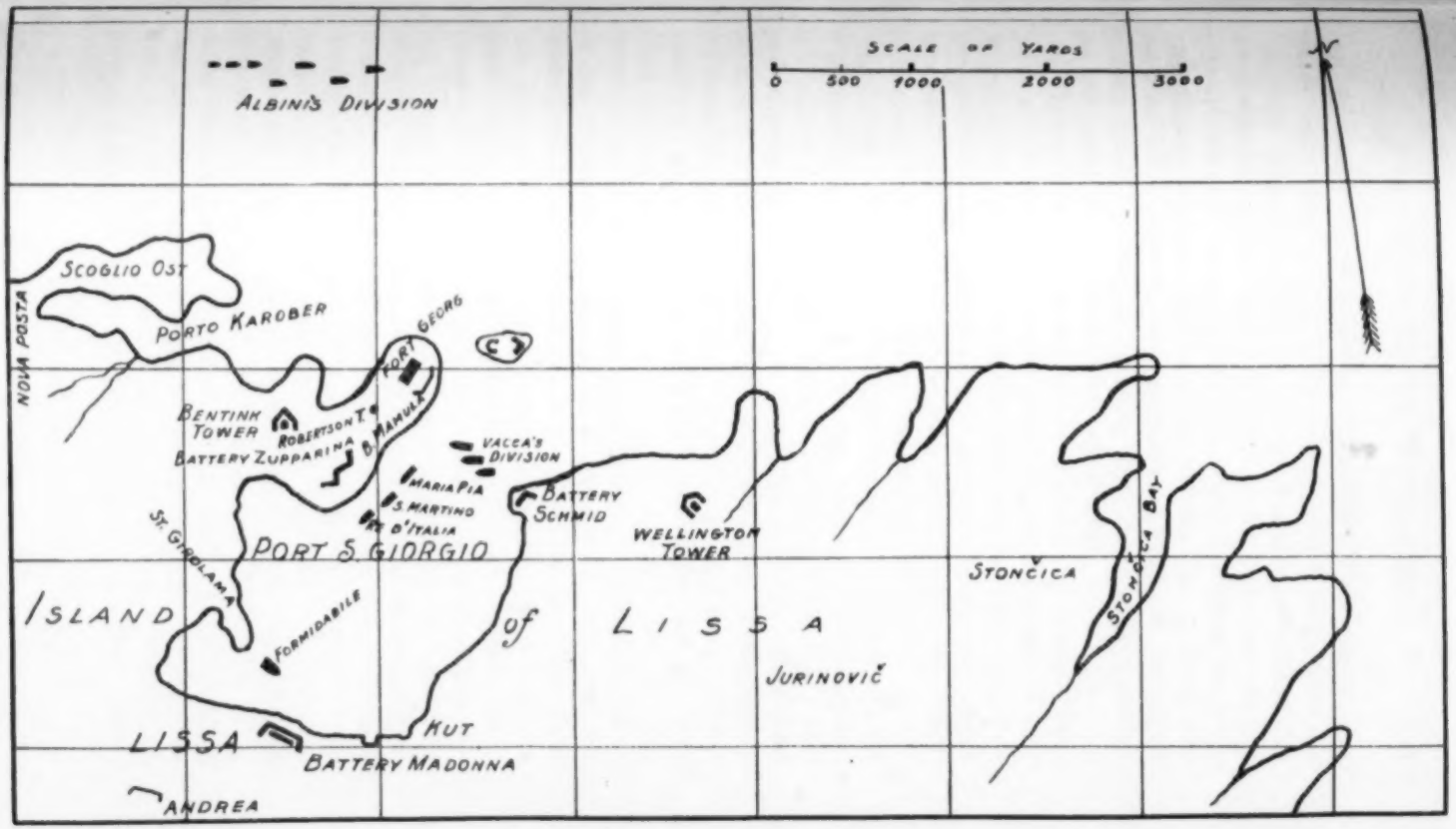
88. At their head came the Formidabile, which, flinging a few shots at Zupparina, brought up at a distance of about three cables from Madonna and turned her broadside against that battery. In vain did Zupparina endeavor, as on the previous day,

to throw its shells through the ports of the ironclad, the rapid approach of which rendered such delicate shooting impossible. Bentinck could not bring a gun to bear; Wellington could fire only occasionally, and then had to exercise extreme caution, and Battery Madonna, with its eight guns on the open rampart, was left alone to maintain the unequal combat, for presently Zupparina was obliged exclusively to confine itself to returning the fire of the flagship. Madonna, nevertheless, steadily concentrated its fire on the Formidabile, which, like a wall, covered the three ships behind her, until they swung clear, whereupon they, too, began to ply the battery with broadside after broadside. The commander of the work, First Lieutenant Jauernig, of the Coast Artillery Regiment, behaved at this crisis with extraordinary coolness, and set a brilliant example of courage and energy.

89. The Austrian 30-pdr. shells did but little damage when they struck the sides of the ironclads; but several of them found open ports and carried death and destruction between decks. The field-guns on Cosmo and Andrea, and the infantry on the slopes and in Kut, cooperated to the best of their ability. A lucky shot from a La Hitte 6-pdr. on Cosmo set on fire one of the ships, and a shell from Madonna brought about a conflagration in another.

90. In the meantime the Formidabile carried out a brilliant and dangerous manœuvre. Dropping an anchor and letting the cable run out, she went slowly astern towards St. Girolamo, thereby not only providing more room for her consorts, but also threatening to take up a position whence she could enfilade Madonna. [See plan.] Yet scarcely had she begun this movement ere Vacca's three ships, the Principe Carignano, Castelfidardo and Ancona, turned round and drew off, followed by the shells from Madonna and Wellington.

91. The Formidabile was left alone, exposed to the guns of Madonna and Cosmo. She was obliged to stop firing, to close her ports, to steam up to her anchor, and then to slip her cable. Twice, as she was doing this, her colors were shot away, but on each occasion new ones were promptly run up. The whole Austrian garrison witnessed the behavior of the ironclad and could not repress its admiration. The Formidabile's gallant captain, Pacoret di Saint Bon, was Italian Minister of Marine



ITALIAN ATTACK ON PORT S. GIORGIO, LISSA, JULY 19, 1866.

from 1873 to 1876, and again from 1891 until his death in November, 1892. Not only at Lissa did he serve his country well.

92. After Vacca's withdrawal, Admiral Persano realized the critical situation of the Formidabile and ordered his own captain to tow her out; but before the Re d'Italia could execute the command, Captain di Saint Bon, with his rigging cut to pieces and with three killed and fifty-five wounded on his decks, managed to steam out of the bay, fired as he went from every Austrian gun that could be brought to bear upon him.

93. During this part of the action most of the enemy's projectiles struck below, or passed over, Battery Madonna. Twice the roof of the barracks was set on fire; but the flames were as often promptly extinguished by the garrison before they could make headway. The loss in the work was astonishingly small, for it consisted only of one killed and one wounded.

94. Fortune did not favor Admiral Persano. The withdrawal of the ironclads from the inner harbor was not of vital importance. Those vessels could hardly have decided the day. The great blow was to have been struck by Vice-Admiral Albini, who was to have landed with 2600 men, and to have taken the already well pounded works in the rear. Had that part of the plan been carried out, the garrison must inevitably have surrendered. But Albini did not carry out his part of the scheme. A craft with troops on board approached Punta Stupiski, at the mouth of the Bay of Comisa, but was driven off by the La Hitte guns on Monte Perlić; another craft made for Stončica Bay, but withdrew after some shells had been thrown at her by Wellington Tower, and a steam-launch, towing three boats towards Porto Chiave was repulsed by the 4th Company of Marine Infantry with rockets. The landing at Porto Karober was not seriously attempted, Vice-Admiral Albini informing his commander-in-chief that the state of the sea rendered it impossible. Persano described this as "singular," seeing that Karober opens to the northeast, and that the wind was from the south. He declared also that his ships, though more exposed, were perfectly steady. It is very difficult properly to characterize Albini's conduct during the whole period of the attack on Lissa. It is on record that there was much suggestive murmuring throughout the fleet. At 8 P. M. the Admiral again collected his fleet at a distance of about eight miles from the island and dropped anchor.

95. At nightfall all fighting had ceased at Lissa. Everywhere, save about Fort Georg, where the flagstaff had been shot away and could not be replaced, the Austrian flag still waved; but Fort Georg, Battery Mamula, and Robertson Tower had been effectually silenced. The scarp and counter-scarp of Fort Georg had been knocked to pieces; the glacis was a series of pits, and the roof of the reserve magazine had been several times pierced. The barracks had escaped serious damage, but the breastwork of the terrace on which the 18-pdrs. had been planted was completely razed. The open batteries had suffered most of all, and the carriages of every one of their guns were useless. Batteries Mamula and Zupparina had a few shell craters in the solid stonework of their scarps, but they would have received much worse damage had not several shells which struck near their magazines failed to burst. The hillside above Zupparina was ploughed up by the projectiles which, thrown from the direction of Novaposta, fell and burst there. A wooden building near the battery was burnt to the ground. Robertson Tower had received few projectiles. Bentinck Tower, and the scarp of the work at its base, were marked with numerous small craters. One shot struck the wall of the powder-magazine in the Tower, but did not penetrate it. The right face of Battery Schmid was a mere heap of earth and stones, but the left half of the work was comparatively uninjured, though the guns were upset and their carriages smashed. Nadpostranje had not been touched. The marks of a few shells near the foot of the glacis were the only evidences that the place had undergone bombardment.

96. The number of projectiles, apart from rockets, thrown by the defence during the two days was 2733.

97. The garrison was naturally much fatigued by its 36 hours' continuous exertions, for it had worked during the whole of the night of the 18th, not only in repairing the works, but also in bringing up munitions and stores, and in substituting fresh gun-carriages for those which had been damaged. By the evening of the 19th the only guns remaining fit for service were, in Zupparina one, in Bentinck two, in Wellington five, in Madonna seven, the artillery on Cosmo and in the interior of the island, and the rocket tubes. The losses of the garrison amounted to twenty-four men killed and two officers and sixty-eight men wounded. Of the casualties, thirty-five occurred in Battery

Schmid, twenty-four in Fort Georg, and twenty-one in Battery Mamula.

98. The Italian losses were as follows:

	On July 18th.		On July 19th.	
	Killed.	Wounded.	Killed.	Wounded.
Re di Portogallo	4	14	..	..
Maria Pia	1	6	..	..
San Martino	..	6	..	..
Formidabile	..	..	3	55
Ancona	..	..	6	17
Palestro	..	9	..	..
Varese	..	1	..	..
Maria Adelaide	2	5	..	..
Governolo	..	..	..	1
	7	41	9	73

making in all a loss of 16 killed and 114 wounded. Several of the ships had been damaged, and scarcely any of them had more than two days' coal remaining on board.

99. In view of the condition of his fleet, and of the possibility, which he himself at length unwillingly admitted, that the prolonged attack on Lissa would induce the Austrian squadron to come out, Admiral Persano found himself in considerable difficulty. Either, on the following day, and before the appearance of the Austrians, he must continue the struggle, and, by means of a vigorous attack by sea and land, secure the fall of the place, or he must suspend his half-accomplished purpose, return to Ancona, fill up with coal and stores, and then act as circumstances might suggest. That night he decided in favor of the former alternative, and ordered Captain di Monale to disembark the troops on the morning of the 20th as soon as the first guns should be fired by the ironclads. But the morning was a dirty one, and it seemed a question whether the landing could be effected. Deputy Boggio,* of the Italian Parliament, who was the Admiral's guest in the flagship, and who was always urging Persano to activity, recommended the disembarkation, but Captain d'Amico, chief of the general staff, was opposed to it, and

*This gentleman's position and actions recall in some degree those of Jean Bon Saint-André in the flagship of M. Villaret-Joyeuse in 1794.

Rear-Admiral Vacca, who visited the flagship, also favored the abandonment of the undertaking and the return to Ancona. Admiral Persano would probably have followed this course had not a chance event occurred to sway his weak mind in the other direction.

100. Soon after sunrise on the 20th, the hired paddle-vessel Piemonte, with a battalion of marine infantry on board, joined the fleet. This decided Persano to continue the attack on Lissa, and he at once ordered Vice-Admiral Albini to proceed with the disembarkation at Karober. The ironclads Terribile and Varese were again to grapple with the batteries in the bay of Comisa, and the commander-in-chief himself, with the other ironclads, was once more to bombard the works in Port St. Giorgio.

101. At 8 A. M., Albini's division, with the gunboat flotilla, was busy off Porto Karober with preparations for the landing; the Terribile and Varese were getting ready to attack Comisa; the other ironclads, off the mouth of Port St. Giorgio, were awaiting the signal to move in and renew the bombardment; the Formidabile was transhipping her wounded to the Washington, and the Re di Portogallo and Castelfidardo had just intimated that their machinery was temporarily out of order, when suddenly the Esploratore (see §56) steamed in fast from Punta Planca, flying the signal—"Suspicious ships in sight."

V. The Battle of Lissa.

102. Admiral Persano, thus, as it were, caught with his boots off, could not for an instant be in doubt that the Austrian fleet was upon him. He made hurried preparations to meet it, though it would appear that, up to that instant, he had never formed any clear conception of how he would endeavor to do so. His long-standing and at length gratified anxiety to have the Affondatore with him, and his untimely transfer of his flag to her, indicate that he had an exaggerated idea of the value of the ram in action. The same is suggested by his first movements after learning of the Austrian approach. His later movements, nevertheless, seem to show that he went into action trusting mainly to the gun. These, I think, were right tactics for an officer with vastly superior gun-fire at his command, as Persano had; but one cannot feel sure that he acted in pursuance of any settled plan, principle, or conviction.

103. As he assumed the enemy to be following in the wake of the Esploratore, Persano ordered his whole fleet to form in line abreast towards the W. N. W.; but presently, when he made out rising smoke in the N. N. E., he changed his front so as to face in that direction. Vice-Admiral Albini was signalled not to proceed with the disembarkation, and later, when it was seen from the flagship that the Italian wooden vessels were not in motion, Persano, with the intention of hurrying them, made: "The enemy is in sight." In the meantime he ordered the corvettes Governolo and Guiscardo to tow the two ironclads which had intimated that their machinery was out of order; despatched the Messaggiere to recall the Terribile and Varese from before Comisa, and with the greater part of his force, steamed in the direction of the foe.

104. That morning the island was shrouded in a thick mist. On shore, therefore, the movements of the Italians were misapprehended, and nothing was known of the coming succor. But at about 10 A. M. the sun burst through, and the garrison, which had expected to be called upon to make a last desperate struggle, saw instead the welcome spectacle of the Italian ships hurriedly assembling on the north side of the island, and of the Austrian fleet in close and imposing formation approaching from the northeast. The sight drew a cheer from the weary defenders of Lissa, who then, in spellbound silence, awaited the playing out before their eyes of the bloody drama in which their persecutors and their saviours were about to take part.

105. The Austrian fleet, twenty-seven* pennants strong, had been under way, in company, since 1.30 on the afternoon of July 19 (see §21). At 2.30 P. M. it passed the lighthouse of Promontore, and then headed to the southeast on a direct course for Lissa. It was formed into three divisions as follows:

I.	II.	III.
Rear-Admiral v. Tegetthoff.	Commod. v. Petz.	Command. v. Eberle.
To Starboard:		
Don Juan de Austria,	G. Radetzky,	Velebich,
Drache,	Donau,	Wall,
Prinz Eugen,	Novara,	Streiter,

*The Stadium, from Pola, did not take up her station till 5 p. m.

Leaders:		
E. H. Ferdinand Max,	Kaiser,	Hum,
To Port:		
Habsburg,	E. H. Friedrich,	Seehund,
Salamander,	Adria,	Dalmat,
Kaiser Max,	F. Schwarzenberg,	Reka,
K. Elisabeth,	Greif,	Narenta,
	Stadium,	Kerka,
		And. Hofer.

The order of each division was what Professor Laughton has called "a double oblique line." This expression does not very well explain it. The order, to describe it more exactly, was, so far as each division was concerned, one of column disposed quarterly to port and starboard, the senior officer's ship occupying in each case the central station or point of the wedge. The second division followed the first, and the third the second. The official Austrian description, literally translated, gave the order of the fleet as "separate divisions formed in salient angle and following in wake." This was the cruising as well as the attacking formation. The description, whatever it be, applies, however, only to the first seven ships of each division. Up to the delivery of the attack, the Stadium proceeded the Erzherzog Ferdinand Max at the head of the entire fleet; the Kaiserin Elisabeth followed astern of the Erzherzog Ferdinand Max; the Greif followed astern of the Kaiser, and the Andreas Hofer, with Narenta on her starboard, and the Kerka on her port bow, followed astern of the Hum. The small craft were thus disposed, chiefly in order to repeat signals. The above, as has been said, was the steaming as well as the fighting formation; but the instructions were to the effect that, upon the actual shock of battle taking place, the second division might be utilized according to the judgment of Commodore von Petz, and that the third division, broken up into three divisions, should remain in the neighborhood of the mêlée, and hold itself in readiness to support or succor the heavy wooden ships.

106. Towards evening on the 19th, the sea got up somewhat under the influence of a southeasterly breeze, and as some of the ships experienced difficulty in keeping station, the speed of

the fleet was reduced to five and a half knots. A little later the commander-in-chief had a conference with his flag-captain, and the officers of his staff, upon the events of the coming day, and discussed the possibility that the fleet might find the Italians already in possession of the harbor of St. Giorgio. It was decided that, in that event, as also in the event of an encounter with the enemy at sea, the ironclads should dash in and endeavor to ram, and that it should be their aim to pour into concentrated broadsides at the shortest possible range. My historical conclusions as to the tactics of the ram will be found in Whole No. 69 of these PROCEEDINGS. Of 74 recorded cases on which I based those conclusions, 48 were, or may have been, known to von Tegetthoff. He certainly overrated the powers of his weapon. At least, however, he knew what his intentions were, and he stuck to them. Moreover, it must be recollected that he was well aware of his inferiority in gun-power. He had already practiced his people in the firing of concentrated broadsides. At the same conference it was wisely decided that, should the Admiral fall in the action, intimation of the event to the fleet should be deferred until a fitting opportunity, and that, in the interval, the flagship should continue to lead, without reference to the seniority of her captain.

107. Towards morning on the 20th the sky became so threatening, and wind and sea increased so much, that the smaller ironclads, the batteries of which were close to the water, were obliged to close their ports. At 7 A. M. the Kaiser Max, which, with the Prinz Eugen and the Stadium, had been temporarily detached ahead to scout, reported "Six steamers in sight," and the flagship almost simultaneously discovered smoke to the southeast; but immediately afterwards a squall of rain came down and prevented further observation. Nothing much more inconvenient could have happened at that juncture; but von Tegetthoff did not hesitate, and pressed steadily onwards towards his goal. At about 9 A. M. the weather began to clear again; the wind went round to the northwest and the sea moderated, although it still kept wet the battery-decks of the smaller ironclads, and remained rough enough to render great caution necessary in working the guns on board all the small craft during the battle which followed. When, at 10 A. M., the mist disappeared, the Austrians saw the enemy right ahead, assembling off the north coast of Lissa.

108. In quick succession the following signals were made by Rear-Admiral von Tegetthoff:

"Clear for action."

"Close order."

"Scouts to their stations."

"Proceed at full speed,"

and, at 10.35, came the historic signal of the day:—

"Ironclads will dash at the enemy and sink him."*

Yet another signal—"This must be the Victory of Lissa"†—had been prepared, but, in consequence of the rapid closing of the two fleets, could not be made. Each signal that went up was greeted with cheers.

109. Every preparation was quickly concluded, and steering south-southeast, the imperial fleet steamed hard for the Italian ironclads which, hastily collected, and disposed in column of single line ahead, were approaching on a north-northeast course.

110. The line was led by Rear-Admiral Vacca in the Principe di Carignano, followed by the Castelfidardo and Ancona. Then came Admiral Persano in the Re d'Italia, followed by the Palestro and San Martino, with the Re di Portogallo, Maria Pia and Varese further astern. The Affondatore was somewhere on the starboard beam of the column. The Formidabile, no longer fit for fighting, was making for Ancona, and the Terribile was on her way from Comisa, and ultimately attached herself to the squadron of wooden ships, which gradually assembled off Travna Bay, and took no part in the action.

111. Such was the general situation when Admiral Persano thought it desirable to shift his flag from the Re d'Italia to the Affondatore, and to take his personal staff with him. To enable him to do so, the Re d'Italia was stopped, and the distance, five or six cables, that originally intervened between her and the ships of Rear-Admiral Vacca's division, was thus greatly increased; for Vacca, who had not been warned, pursued his course. The admiral passed from one ship to the other in a launch, which, strange to say, was then turned adrift and afterwards picked up by the Governolo. While Persano was shifting his flag, the Principe di Carignano, at 10.43 A. M., opened fire at a

* "Panzerschiffe den Feind anrennen und zum Sinken bringen."

† "Muss Sieg von Lissa werden."

LISSA, JULY 20, 1866.
THE AUSTRIAN ATTACK.

LISSA, JULY 20, 1866. THE FIRST SHOCK.

distance of some cables upon the advancing Austrians, and her example was presently followed by all the other Italian ships. One of the first projectiles to be discharged killed Heinrich, Freiherr von Moll, captain of the Drache, but the ship was promptly taken in charge by Linienschiffs Fähnrich Weiprecht* until Lieutenant Matthieu could be summoned to assume the duty. What possessed Persano to change his flagship at the last moment, in such haste, and without notifying the fact by signal to his fleet, has never been fully explained. He was, however, notoriously a great believer in the offensive and defensive powers of the ram Affondatore. Probably his besetting infirmity of purpose had prevented him from making up his mind at an earlier moment. The ship at that time had a speed of about 11 knots, but was very unhandy, and occupied 8½ minutes in turning a complete circle.

112. The Austrian first division, which had a little thrown forward its port ships, returned the fire but continued its advance. Dense smoke presently enveloped both fleets, the consequence being that several Austrian ironclads, including the flagship, were unable to see the position of the Italian vessels, and passed through the wide gap between the Ancona and the Re d'Italia, thus unwittingly cutting off the head of the Italian column. As soon as this became evident, most of the vessels on the port quarter of the Ferdinand Max kept away to port to occupy the attention of Rear-Admiral Vacca, while those on her starboard quarter kept away to starboard to engage the rest of the Italian column as it came up. The Ferdinand Max herself having passed through the line, turned round to port and made for the central hostile group, which, in the meantime, had also swerved a little to port as if with the intention of falling upon the second Austrian division—the division of heavy wooden ships. Perceiving this intention, the Austrian ironclads on the original right turned somewhat again to protect the second division, which, with great gallantry, made for the rear portion of the Italian line. Thereupon ensued a regular mêlée, which, from moment to moment, increased, both in complication and in magnitude, and which it is impossible to describe in detail. From that time until the end of the engagement, each ship manœuvred independently,

* Afterwards commander of the Arctic discovery ship Tegetthoff.

striving to ram, to escape the ram, or to interpose for the protection of a threatened consort. Vessels passed one another continually within pistol shot, emerging from one bank of obscurity to enter another, and often having barely time to discharge their concentrated broadsides into an enemy of whom they caught but vague and fleeting glimpses. The national ensigns were not distinguishable amid the rolling volumes of steam and smoke of powder and coal, and it was fortunate for both sides that all the Austrian ships were painted black, and all the Italian gray. Von Tegetthoff's plans were of so simple and elementary a character, and they left so much to each captain's discretion after the first shock of action, that the Austrian commander-in-chief deliberately refrained from making any signals after the battle had begun. The smoke would have prevented signals from being taken in had he made them. But a modern engagement, fought with smokeless powder, may be, and, I think, should be, controlled from first to last from the flagships. There ought to be no mêlée in future. The work of each ship ought to be part of the general tactical scheme. All that can be said as to the conduct of the action was that, broadly and with some exceptions, most of the Austrian wooden ships, having turned a little to starboard, were engaged with the ironclads of the Italian rear; that the right wing and center of the Austrian ironclad division were engaged with the ironclads of the Italian center, and that the left wing of the Austrian ironclad division, and the rear of the Austrian wooden ships, were engaged with the Italian van, which, under Vacca, had circled round to port.

113. In the meantime, Persano, in the Affondatore, found his way between the Re d'Italia and the Palestro, and appeared in the immediate rear of the first Austrian division, making repeated and vain attempts to ram now one ship and now another, and then working round to the southward.

114. Commodore von Petz, of the second Austrian division, narrowly escaped the Affondatore. Seeing that the Italian wooden ships were lying off Lissa, the Commodore had made up his mind to get at them if possible, and, with that object, had turned to starboard, and formed the vessels of his division into something like line astern of him. Captain Ribotti who, in the Re di Portogallo, commanded the Italian rear, had been at first inclined to proceed to the assistance of the Italian center, but

awaking to the Commodore's design, had turned to port, hoping to cut him off in such a manner as to leave him at the mercy of Vice-Admiral Albini's wooden division which was apparently coming out. Von Petz, on his part, had turned to meet Ribotti's division, and had brought his seven ships, as well as the Kaiserin Elisabeth, into action with the Re di Portogallo, Maria Pia, Varese and San Martino, this last having for a time delayed her progress. Such was the position of affairs in the southern part of the scene of action, when the Affondatore suddenly rushed out of the smoke on the Kaiser's starboard beam, and endeavored to ram the wooden line-of-battle ship. Twice she charged, each time firing several 300-pdr. projectiles, one of which wrought great damage, dismounting an upper deck gun, putting out of action six men at the Kaiser's wheel, and smashing engine-room telegraph, binnacle, and much else. But the Kaiser was able, while eluding the shocks, to deliver a couple of concentrated broadsides, which did much damage to the Affondatore's top-hamper and deck, and induced the ram to sheer off. After the second attempt at ramming the two vessels scraped alongside one another, exchanging small-arm fire, which killed Linienschiffs Fähnrich Robert Proch, who fell from one of the Kaiser's tops to the deck.

115. Scarcely was the wooden line-of-battle ship free from her formidable opponent ere she was threatened by the Italian iron-clad Re di Portogallo, which, with the Maria Pia and Varese, had brought a heavy fire to bear upon the leading ships of the Austrian wooden division. Many of their projectiles flew over the Kaiser and struck the Novara, disposed to starboard, and the Erzherzog Friedrich and Kaiserin Elisabeth, disposed on the port quarter, of the two-decker. One killed Captain Erik of Klint, whose place, as commander of the Novara, was taken by Lieutenant Schröder; another struck the Erzherzog Friedrich below the water-line, causing her to make nineteen inches of water an hour. This, however, was kept in check by the steam-pumps.

116. So dense was the smoke that the Kaiser did not see the Re di Portogallo until the latter was quite close, and was approaching at full speed with the obvious intention of ramming. The two-decker could have escaped the blow by making a quick movement of her helm, but had she done so she would have

exposed to immediate destruction the Kaiserin Elisabeth and Erzherzog Friedrich, which were at barely a cable's distance. Trusting, therefore, to the weight and structural strength of his ship, Commodore von Petz decided to attack his armored foe. Turning first a little to starboard, and then hard to port, he placed his enemy's broadside fairly in front of him and rammed at full speed, striking the Re di Portogallo on the beam abreast of the machinery. In was exactly 11 o'clock, 17 minutes after the firing of the first shot by the Italians.

117. Captain Ribotti, conscious of what was intended, turned to port just before the moment of impact and so weakened the force of the blow. Ribotti subsequently admitted that had he not done this, he would have been sunk. The effects of the shock, of the scraping passage along the ironclad's port side, and of the Italian broadside, discharged at close quarters, were terrible for the Kaiser. The bowsprit and entire stem of the two-decker were torn out of her in such a way that presently the foremast toppled over, carrying away with it the funnel and the imperial crown from the Kaiser's figure-head was left on the Re di Portogallo's deck. Nor did the ironclad escape scot-free. She lost two anchors, and several boats; of four field-guns which stood on her quarter-deck, one was knocked overboard; eleven of her port lids were smashed, and her side-armor, over a length of more than sixty feet, was displaced. In spite of her misfortunes, the Kaiser, as the Re di Portogallo swung round to starboard after the collision, managed to pour in a heavy fire from the forward guns of her main battery, discharged at short range. Several of the shot struck the ironclad below her armor, and a 24-pdr. shell from a rifled gun burst on her deck. This was followed up by repeated broadsides, and very soon the Re di Portogallo disappeared in the smoke. The two-decker was not yet, however, at the end of her adventures. Suddenly, at a distance of four cables, another ironclad, probably the Maria Pia, loomed up. Although the wreckage that overlay her funnel had by that time caught fire, the Kaiser at once began again to engage. Two Italian shells burst between decks and put part of her battery out of action; a steam-pipe was shot through; the quarter-deck was almost swept clean; and the officer in command of the quarter-deck quarters, Linienschiffs-Fähnrich Hugo Pogatschnigg, was badly hit. Nor was this all. The port side of the ship

was on fire, and the chief engineer sent up word that the machinery could no longer be trusted, and that, owing to the condition of the funnel, he could provide but very little steam. In the meantime the fire over the wreck of the funnel grew more serious; the steering-gear was damaged by a shot; the forward batteries were no longer able to take much share in the action; and the ship was, in short, so severely mauled that her captain at length came to the conclusion that he must endeavor to withdraw her out of gunshot. He therefore headed her for Port St. Giorgio; and he was followed thither by most of the large wooden ships and by some of the gun-vessels which had previously afforded all possible support to the two-decker, and had attracted to themselves a good many attentions from the hostile ironclads.

118. Several of these wooden craft were much damaged. The Schwarzenberg had received seven shots in her rigging, besides one in her foremast and one below the water-line, and leaked so badly that all her pumps had to be kept at work. The Adria had suffered grave injuries to her rigging and boats; had had her ensign shot away; had been thrice set on fire, and had four men badly and two men slightly wounded. Two dockyard laborers who were on board, and who were endeavoring to stop a hole which an 80-pdr. shell had occasioned near the water-line, were struck by a second shell and blown to pieces, and the burning fragments caused by the explosion scattered themselves in the neighborhood of the entrance to the magazine in such a manner that only by the coolness of the chief gunner, who promptly opened all the valves, was a terrible disaster averted. As for the Novara, besides her captain, she lost six killed and twenty wounded.

119. While the rear of the Italian line had thus unexpectedly been held in check by the Austrian wooden vessels, the two leading ironclads under Rear-Admiral Vacca, after Tegetthoff had broken through, had pursued their course, turning, however, somewhat to port, and so removing themselves from the Italian center, which, thus in a measure isolated, was assailed by the main strength of the Austrian ironclad division, and found itself in a critical position.

120. Tegetthoff's flagship, the Erzherzog Ferdinand Max, had tried to ram two hostile ironclads, but had struck them at so sharp an angle as to produce no effect of importance. Upon the

second occasion, however, the blow, delivered on the starboard quarter, brought down the enemy's mizzen topmast and gaff, the latter, with a gigantic tricolor attached to it, falling on the flagship's forecastle. Carcovich, a quartermaster, ran forward, and, after one ineffectual attempt, tore or cut the flag clear, and under a heavy small-arm fire, made it fast to a stanchion, where it remained.

121. Since, according to the Italian reports, no vessel that survived the day was rammed save the Re di Portogallo, it must be concluded that the two ships which were rammed were the Re d'Italia and the Palestro. That it was the Palestro which thus lost her flag to the Erzherzog Ferdinand Max is rendered the more probable by the fact that the gunboat Reka afterwards saw the Palestro when on fire, and noticed that she had no ensign at her peak.

122. The Re d'Italia, the leading ship of the Italian center, being supposed to be still Persano's flagship, was a natural object of general attack, and, immediately after Tegetthoff had broken the line, was surrounded by four Austrian ironclads, among which was the Erzherzog Ferdinand Max. The Palestro endeavored to proceed to the assistance of the sorely pressed vessel; but two Austrian ironclads opened a heavy fire upon her and barred her way. The Palestro's iron sides effectively resisted the Austrian shot, and little harm had been done to the ship by the collision with the flagship of Tegetthoff. A shell, however, passed through her unarmored stern, and burst in the ward-room close to the magazine. It at once created a conflagration, and obliged the Palestro to go about to port in order to get out of action, and to have leisure to repress the flames. In the meantime the steering-gear of the Re d'Italia seems to have been damaged, for the vessel lay isolated in the midst of several Austrian ironclads and did not manœuvre. The Palestro went away to the northwards, and the San Martino withdrew towards the southwest, followed apparently by the Don Juan de Austria, and later by the Kaiser Max. It was then that the most dreadful and dramatic episode of the battle took place.

123. Rear-Admiral von Tegetthoff, gazing down from the bridge, where he stood surrounded by his staff, and betrayed a coolness to which even Italian writers have paid chivalrous tribute, could not but note the condition of the Re d'Italia. That

unfortunate ship, no longer obeying her helm, could only move straight ahead or straight astern. She was firing both broadsides; she had crowds of men ready on deck to board any opponent who might give her the opportunity; she was fighting with the courage of desperation.

124. Captain Freiherr von Sterneck, of the Erzherzog Ferdinand Max, fought his ship from half-way up the mizzen shrouds,* and ordered her to be headed at full speed for the port side of the Re d'Italia. When about two-thirds of a cable from her he ordered his engines to be stopped. The Re d'Italia made every possible endeavor to go ahead, so as to avoid or at least diminish the effect of the shock; but an Austrian ironclad barred the way. Instead of trying to ram the enemy ahead of her, the Re d'Italia attempted to go at full speed astern, but at the very moment when the ship had ceased to forge ahead and had not begun to feel the effect of the reversed screw, and when, in consequence, she was practically stationary, she was struck full amidships by the Austrian flagship, which flung at her a weight of about 5000 tons at a speed of eleven and a half knots. The blow was dealt over the engine-room. Armor, backing, frames, beams and planking all crumpled inwards before that mighty thrust. The hole that was made was estimated to have an opening 300 square feet in extent, half of it being below the waterline. Below decks in the Erzherzog Ferdinand Max, where no one expected the shock, the people were thrown violently forward. The chief engineer, in pursuit of previous instructions, immediately reversed his engines, and withdrawing the fatal ram, which had penetrated to a depth of six and a half feet, freed the flagship from her mortally injured enemy.

125. The Re d'Italia, under the force of the blow, heeled over slowly about twenty-five degrees to starboard, swung back rather suddenly to port, plunging her huge wound into the waves and then almost instantly sank. For the victors it was a sublime yet shocking moment, when the enemy's deck, crowded with human beings who cheered and fired to the last, tilted up, till men, guns, boats and gear slid down in struggling confusion, and when a brave and splendid ship disappeared forever in 200 fathoms of water.

*Compare Farragut at Mobile Bay.

126. As the ship sank, some of her people were observed to hurry aft as if to haul down her ensign, but two gallant officers, Signors Razetti and Del Santo, forcibly prevented them, and the ship went to the bottom with the Italian flag still flying. This was at 11.20 A. M., only thirty-seven minutes after the action had begun.

127. Upon the turbulent water where the Re d'Italia had floated there were only some fragments of wreck and a few struggling survivors, who, having jumped clear of the vessel, had not been sucked down with her. For some seconds the victors looked in awed silence at the scene. Then a tumultuous hurrah went up from every Austrian ship within sight.

128. The collision had bent in the plates on the Ferdinand Max's bows, and, sheering off the heads of a few rivets, had given rise to a slight leak. But in no other respect was the Austrian flagship injured. Von Tegetthoff's first care was to save his late enemies, some of whom clung to spars and floating débris, while others supported themselves by swimming. One of the starboard boats, the only one which would float, was ordered to be lowered, but ere she could be put into the water an Italian ironclad, clearly intent upon ramming, appeared upon the flagship's port quarter. The enemy was probably the Ancona. Freiherr von Sterneck, with great composure avoided the blow, but the two ships passed one another so closely that the people in the Ferdinand Max's port battery were unable to get the rammers into the muzzles of their guns. The enemy fired several rounds, the smoke of which entered the Ferdinand Max's ports, but there were no signs of any projectiles, and it was supposed that the guns were not shotted. The captain of the Ancona in his report practically admitted that they were not, and ascribed the omission to the fact that his guns used sometimes iron and sometimes steel projectiles. As the choice of projectiles, in view of the work to be done, would be naturally delayed until the last minute, it is possible that, in the excitement of action, the projectile was altogether forgotten, the guns being, of course, muzzle-loaders, and the powder being put in first. It has been alleged, moreover, that after the action some Italian guns were found to have been loaded with the powder on top of the shot. No doubt many of the guns' crews lost their heads completely.

129. The Ferdinand Max and the Ancona separated without further hostile action. Other Austrian ships, in addition to the flagship, made repeated efforts to pick up the survivors of the Re d'Italia, but were as often attacked and obliged to consult their own safety. The Kaiserin Elisabeth, for example, which was close to the flagship, and to the northward of the Re d'Italia at the moment when the latter foundered, did her best; but an Italian ironclad got across her stern, and, firing briskly, caused her some loss, and drove her off. The screw schooners, Kerka and Narenta, which, owing to their bad speed, were, at the opening of the action, six cables behind their division, but which followed into the fray, also approached the scene of the catastrophe, but while they were about to render help, they found themselves within range of two hostile ironclads, one of which was the burning Palestro, and were forced to withdraw.

130. Meanwhile the Ancona headed for the Re di Portogallo, which was much pressed by several Austrian ships, and on the way she came into accidental collision with the Varese, which not only had been the last of her division, but also had remained somewhat astern of station, and was now likewise pressing on to succor the Re di Portogallo. The Varese had an armor-plate dislodged, and both ships suffered some damage. Moreover, their rigging became so entangled that an appreciable time elapsed ere they could get free again. The Re di Portogallo, soon after her encounter with the Kaiser, had turned to port to clear the Austrian wooden ships, and then to starboard to escape two hostile ironclads, and, separated for a period from the ships of her division, had the very greatest difficulty in avoiding her opponents. While, nevertheless, she was engaged in repairing damages, and was still in a most precarious situation, she made an effort to ram an Austrian wooden frigate, and so to make a way of escape for herself. Captain Ribotti believed this frigate to be the Novara, but she was undoubtedly the Schwarzenberg, which received the Re di Portogallo with a concentrated broadside, and wrought fresh injuries both to the masts and to the hull of the ironclad. At last, however, Ribotti freed himself, and joined Rear-Admiral Vacca, who had just previously made the signal: "Form column of line ahead, without reference to the order of the ships."

131. The Maria Pia, which also belonged to the rear or

Ribotti's division, and which, like the Varese, had desired to succor the Re di Portogallo, had been obliged to describe a wide circle in order to afford sea-room to the entangled Ancona and Varese, and had thereby lost so much time that her help became unnecessary. She then attempted to bar the way to two Austrian ironclads which appeared to be making for the Italian wooden division, but she was attacked by two other Austrian ships. She tried to ram one of these, which crossed her bows, but the Austrian turned quickly to starboard, receiving, however, a full broadside and a volley of musketry from the Italian as the latter swept past. The Maria Pia thereupon headed for her ironclad consorts. These were little by little withdrawing to the westward out of action. It was probably at that time that the Maria Pia and San Martino collided. The latter received some damage forward—twisted her ram, bent or displaced several of her armor-plates, and sprang a slight leak. The former lost one armor-plate. This was the final episode of the action, and at 12.10 P. M. Rear-Admiral von Tegetthoff signalled to his fleet to close upon the flagship.

132. At the beginning of the action the two leading ships, the Principe di Carignano and the Castelfidardo, of the van or Vacca's division, exchanged a few shots as they passed with the Kaiser Max, Habsburg and Salamander. In the last-named, a projectile, one of the first, struck the conning-tower, and the splinters entering, wounded the captain, the signal-cadet and the signal-quartermaster, and smashed the conning-tower binnacle. Another projectile shattered the mizzen top and did further damage. In the course of the action, and towards the conclusion of it, the Italian van placed itself in the rear of the Austrian wooden vessels. With the object of breaking through these and joining Faa di Bruno's and Ribotti's divisions, the Carignano and Castelfidardo altered course to the southward; but the well-directed fire of the closely grouped ships of the Austrian rear kept the foe in check, and not only prevented him from venturing to ram any of the wooden craft, but also rendered him unable to do more than make an ill-directed return. In this long-range action the Austrian wooden frigates Donau, Radetzky and Schwarzenberg took part with their pivot-guns, and were well supported by several ships of the third or gunboat division, although the latter, owing to the tumbling sea, found it exceed-

ingly difficult to use their guns, some of which jumped from their mountings, or broke from their racers, and took charge. Among these craft were the gunboats Hum, Wall and Streiter, and the paddle-vessel Andreas Hofer, which last had attached herself to the second division, and kept in its wake. The Reka and Seehund had got up nearly with the leaders of the wooden division, while the Dalmat and Velebich had dropped somewhat astern of it.

133. While the Austrian ironclads were closing on the flagship, great part of the wooden squadron was already on its way to Port St. Giorgio. The two-decker, Kaiser, which, as has been related, had, owing to the damage inflicted upon her, been obliged to retire from action, was accompanied out of gunshot by the Erzherzog Friedrich, the Seehund and the Reka. Next came the frigates Schwarzenberg, Radetzky, Adria and Donau, and the gunboats Hum, Wall and Streiter, and astern of them the little Andreas Hofer. On her way the Kaiser did all that lay in her power to extinguish the fire which was still raging in her, and she was thus engaged when suddenly, on her starboard side, there appeared the Affondatore, which, after the vain attempt upon the two-decker, had described a big circle to port, repaired damage as well as possible, and steering along the north coast of the island, now threatened to bar the Kaiser's progress. Thrice she seemed to start ahead with the intention of ramming the Kaiser, which, in spite of her injuries, as often turned at bay, and, from amid the smoke and flame which covered her, fired broadside after broadside and kept off the foe. She was, at this crisis, nobly supported by the wooden ships astern of her, and later by the ironclads Don Juan and Prinz Eugen, all of which threw a perfect hail of projectiles upon the Italian ram, undeterred by the approach of the Principe di Carignano, Castelfidardo, Re di Portogallo, Ancona and Varese, which, in response to Vacca's signal, kept up a distant and resultless fire. Upon the third occasion, the Affondatore, at high speed, steamed to within one cable of the Kaiser and then suddenly fell away to starboard. She still, however, for some time, followed up the two-decker, but at last, with a damaged anchor, several shot through her deck, and a fire in her lower hold, turned to join the Italian wooden ships. The Kaiser returned her last shot at a distance of ten cables.

134. According to Italian accounts, Persano had personally directed the commander of the Affondatore, Captain Martini, to ram the Kaiser, but when the ships were in close proximity, and only the order "starboard your helm" was needed to produce the fatal result, Persano gave the word "port your helm," and stuck to it in spite of the representations of those around him. Persano himself declared that, chancing at that moment to observe for the first time how terribly the two-decker had suffered, he had not deemed it proper to further concern himself with so helpless a foe.

135. At about the same time the Don Juan de Austria received from the Affondatore, which had unceasingly fired her 300-pdrs., a shot that struck an armor-plate between two ports, a second on the armor below the water-line, and a third that shattered the butt of the bowsprit.

136. The two-decker, freed from the presence of her dangerous enemy, continued her course, uninterfered with, and reached Port St. Giorgio at 1.15 P. M., anchoring across the harbor mouth. The gunboat Reka followed her in, but, seeing the Kaiser signal: "There is hope of mastering the fire," she remained for only half an hour. The remaining wooden ships which, after the departure of the Affondatore, considered that the Kaiser's peril was over, again headed to the northward, led by the Schwarzenberg, to rejoin the ironclad division. This (in consequence of Tegetthoff's signal made at 12.20 P. M.: "Follow in wake of the Admiral") met the northward steering squadron half-way, and the fleet being thus reassembled, the commander-in-chief as quickly as possible reformed it in three columns of divisions in line ahead disposed to starboard, the iron-clad division taking the post of honor next the enemy. The course steered was northeast. The new formation was such as permitted of the original wedge-like formation being quickly resumed in case of need. While it was being carried out several of the Italian wooden ships of Vice-Admiral Albini's division opened a lively, but distant and useless fire.

137. As soon as the Affondatore had withdrawn out of gunshot of the Austrian wooden ships, Admiral Persano hastened to that portion of his force which was still engaged in moving along the northwest coast of Lissa. His intention was to order it to continue the engagement. Vice-Admiral Albini declared that

thrice during the battle he had endeavored to approach the scene of action, but on each occasion had been prevented by Austrian ironclads. Of the Austrian ships a few, at about 11 o'clock, had noticed a forward movement of the Italian wooden vessels, which, however, had quickly retired again. The fact is, that the whole of this squadron (with the ironclad Terribile* which clung to it) and its 400 guns, remained idle spectators of the action from beginning to end, and, after the conclusion of the fight, did nothing but fire a few ineffective rounds at a great range. Albini's passive attitude cannot but have had influence upon the fortunes of the Italian fleet on that day, and is the less justifiable, seeing that the behavior of the Austrian wooden division, the almost worthless paddle-vessels of which took gallant part in the fight, invited him to fling aside hesitation, and should have spurred him to emulation. It must be admitted that Persano displayed little more ineptitude than some of his subordinates.

138. Persano was certainly very angry at the continued inactivity of his wooden division, and approached it at full speed with the signals flying: "Attacate il nemico appena a portata" ("Closer action"), and "Surround the enemy's rear," by which he meant those Austrian ironclads which had had the last engagement with the Maria Pia, and, having been detained by it, were still seeking to rejoin their consorts. Persano also signalled: "The fleet, with individual freedom of movement and manœuvre, will go in chase of the enemy," and, in the Affondatore, he led the way against the main body of Austrian wooden ships which had just then quitted the Kaiser in order to join the ironclads. Persano hoped, by a quick and dashing onset, to prevent the junction; but, once more his wooden division left him in the lurch, although the Principe Umberto showed a good example, and, steaming after the Admiral, opened a brisk fire. Of the Italian ironclads only the Re di Portogallo obeyed the signal.

139. Persano, supposing that his signal was not understood, steamed down the whole line of the fleet with it flying, but the golden moment had passed, for the Austrian squadron, complete save for the Kaiser and the Reka, had assembled, and, already formed in three columns, was steaming northeast.

* Her captain was afterwards tried for misconduct.

140. Rear-Admiral von Tegetthoff, who, while his ships were closing around him, saw the burning Palestro, at a distance of about three-quarters of a mile to the northwest, making in the direction of the Italian wooden squadron, had ordered the Kaiser Max, at 1 P. M., to cut her off. The flagship herself had also proceeded towards the enemy, and had been followed by other vessels. But the Palestro, whose engines were still in good order, was not to be caught, and had been presently taken in tow by the paddle corvette Governolo, which had been specially detached for the purpose by Albini. Escorted by the Indipendenza, she had closed her consorts, one or two of which, including the Affondatore, had meanwhile advanced to protect her.

141. The Italian fleet subsequently altered course more than once, but the general direction of its movement was to the west-northwest. A few rounds were fired by each side, but the range steadily increased. At one moment it appeared as if the Italians, headed by the flagship, would again advance to the attack. The motions which gave rise to this impression upon the minds of those in the Austrian fleet were probably occasioned by the inclination of a few Italian vessels to act upon Persano's signals: "Closer action," and "The Admiral reminds the fleet that the ship which is not in action is not in her station." But, ere long, even Persano was obliged to surrender all idea of renewing the engagement. He learnt of the sinking of the Re d'Italia; he saw the critical situation of the Palestro, and the San Martino apprised him by signal that, owing to the extent of her damages, she could not keep station. The Italians finally headed for the channel between Lissa and Busi, and hostilities thereupon ceased.

142. While, therefore, the Austrian fleet, in order of battle, and complete except as regards the Kaiser and the Reka, which were in Port St. Giorgio, occupied the scene of action, the Italian fleet retired to the westward of Lissa. To follow up the retreating foe was not within the province of Admiral von Tegetthoff. His inferiority in guns forbade him to enter upon a long range engagement, and the very unequal speed of his ships also prevented him from entertaining the idea. Moreover, the enemy still possessed so many intact fighting units that it would have been sheer temerity on the part of the Austrians to imperil the results which had been already gained.

143. Since everything pointed to the fact that the Italians were

as little disposed as he was to reopen the question on that day, Tegetthoff altered course to the southeast, and, at about 2 P. M., directed the gunboats to proceed ahead to Port St. Giorgio. The heavy wooden division followed them; then the ironclad division, and, last of all, the flagship, which reached the harbor shortly before sunset, and was greeted with hearty cheers from the assembled fleet. While the gunboats were still under way, a violent explosion was heard, and those who were looking in the direction of the Italian fleet, saw the Palestro go into the air.

144. The commander of that vessel, Commander Alfredo Capellini, who had been invited by the convoying craft, Governolo and Indipendenza, as well as by Rear-Admiral Vacca, to take advantage of the boats which were sent to him, and to place his ship's company beyond the reach of danger, considered it as a point of honor, in spite of the ever-increasing risk, not to quit the vessel, and determinedly refused the proffered assistance. "Those who wish to go, may go," he said; "for my part, I remain." Following the example of their chief, the entire ship's company stuck to the Palestro, only the sick and wounded being removed to the Governolo. Every man went to his post and worked with the greatest devotion to combat the fire. The powder-magazine was flooded, and danger from that quarter seemed no longer to be apprehended; but the conflagration reached a compartment where, during the action, a number of filled shells had been placed. A great blaze of flame shot out from the ports on each broadside; a deafening report followed; wreckage and mangled corpses flew high in the air, and in an instant all was swallowed up by the waves. It was 2.30 P. M. when, in sight of both fleets, this final act closed the tragedy of the day.

A statement of the losses on the Austrian side is given in the table below. To this it may be added that the officers killed were: Captain Heinrich, Freiherr von Moll, commanding the Drache; Captain Erik of Klint, commanding the Novara; and Ensign Robert Proch, of the Kaiser; and that the officers wounded were: Captains Anton von Petz (Kaiser) and Carl Kern (Salamander); Lieutenants Julius Steiskal, Hermann Freiherr von Spaun, Joseph Frank and Franz, Freiherr von Minutillo; Ensigns Anton Kloss, Ferdinand Gebhardt and Hugo Pogatschnigg; Naval Cadets Ignaz Mader, Eduard Hanslik, August Süss and Victor Sambucchi, and acting Naval Cadets Adolf Hlouschek and Stefan, Ritter von Doymi.

	Shots fired.	Shots received.	Killed.			Wounded.					Total killed and wounded.
						Offic's.		Men.			
			Officers.	Men.	Total.	Slightly.	Badly.	Slightly.	Badly.	Total.	
Ferdinand Max	156	42	..	1	1	1	1	4	1	7	8
Habsburg	170	38	..	..	..	..	..	..	..	..	..
Kaiser Max	217	28	..	..	..	..	..	2	1	3	3
Don Juan de Austria	277	41	..	1	1	..	..	4	..	4	5
Prinz Eugen	234	21	..	..	..	..	..	1	..	1	1
Drache	121	17	1	..	1	1	..	..	5	6	7
Salamander	211	35	..	..	..	..	2	7	..	9	9
Kaiser	850	80	1	33	34	2	3	36	34	75	39
Novara	342	47	1	6	7	4	..	13	3	20	27
Fürst Schwarzenberg	286	9	..	..	..	..	1	..	1	2	2
Graf Radetzky	289	..	..	..	..	..	..	..	..	..	..
Adria	221	27	..	2	2	..	..	2	3	5	7
Donau	326	7	..	1	1	..	..	..	2	2	3
Erzherzog Friedrich	250	9	..	..	..	..	..	..	..	..	..
Hum	48	3	..	..	..	..	..	..	..	..	..
Dalmat	75	1	..	..	..	..	..	..	..	..	..
Valebich	93	..	..	..	..	..	..	..	..	..	..
Wall	32	..	..	..	..	..	..	..	..	..	..
Seehund	51	..	..	..	..	..	..	..	..	..	..
Streiter	55	..	..	..	..	..	..	..	..	..	..
Reka	92	..	..	..	..	..	..	..	..	..	..
Kerka	16	..	..	..	..	..	..	..	..	..	..
Narenta	17	..	..	..	..	..	..	..	..	..	..
Kaiserin Elisabeth	71	4	..	1	1	..	..	2	2	4	5
Greif	5	..	..	..	..	..	..	..	..	..	..
Andreas Hofer	51	3	..	..	..	..	..	..	..	..	..
Stadium	..	..	..	..	..	..	..	..	..	..	..
	4,556	412	3	35	38	8	7	71	52	138	176

145. The damages received by the Austrian ships were not of a very important character. Except the two-decker, the clearing and refitting of which necessitated twenty-four hours' work, the entire fleet remained fit for action. Engines and steering-gear were in good order; only four guns were dismounted; the Styrian armor-plates had behaved well, and, save for a few dents, were as good as ever. One of the plates in the bow of the Erzherzog Ferdinand Max was bent in by the force of the collision with the Re d'Italia; in the Don Juan a plate between two ports, and another below the water-line, were injured by 300-pdr. projectiles. Of the wooden ships, the Schwarzenberg and the Erzherzog Friedrich were leaky and made water; but this could be kept under by the pumps, and did not detract materially from the fitness of the vessels for further work. In several ships fires had been occasioned by bursting shells, but all these had been promptly extinguished. The greatest sufferer from fire was the Adria.

146. Of the Italian fleet, the Re d'Italia and the Palestro had disappeared. The San Martino in the battle, and the Formid-

abile during the attack on Lissa, were rendered unfit for action. All the remaining ironclads suffered more or less damage, the Re di Portogallo especially. Only the Terribile, and the inactive wooden ships were uninjured. The Maria Pia had a plate smashed and a projectile sticking in her armor. She had also been struck by several shot, principally abaft, where she had been set on fire, and her magazine had been imperilled. The San Martino had a projectile in her armor; another penetrated a plate nearly four inches thick and half the backing, and several plates were damaged. The ram was twisted to the left in consequence of the collision with the Maria Pia, and although the ship was at once repaired, she continued to make water as late as September. She had been badly mauled; several shells had burst in her, and two fires which had broken out in her had been quenched with difficulty. Seven plates were removed from their places. In the Castelfidardo, a shell bursting in the captain's cabin did much damage and occasioned a fire. The Ancona lost several plates. A shell burst between decks; another put fourteen men out of action; all the spars and rigging were rendered useless. The Carignano had a plate penetrated; and a shell burst beneath the conning-tower. The Varese had only slight injuries. The Re di Portogallo suffered greatly. Sixty feet of armor was destroyed by the collision with the Kaiser. The ship had no plates penetrated, but many bent and forced inwards. The Maria Adelaide received fourteen projectiles in her hull; a shell, entering under water, penetrated to a coal-bunker, but failed to kindle a fire there, and the masts and rigging were badly knocked about.

147. The losses of men were also serious. As has been already said, the Italians had fifteen killed and 114 wounded in the attack on Lissa. Of the 600 people on board the Re d'Italia, nine officers and 159 men were saved, 116 by the Principe Umberto, and the rest by the Messaggiere, Stella d'Italia and Affondatore, while eighteen reached Lissa by swimming. Of the 250 people on board the Palestro only one officer and nineteen men were saved. The other losses of the Italian fleet amounting, however, to no more than five killed and thirty-nine wounded. I can find no particulars of the expenditure of ammunition.

148. The Austrian dead and badly wounded were landed at Lissa on the evening of 20th, and the necessary work on the ships was begun without delay. After sunset the ironclads

Habsburg and Prinz Eugen, and the gunboats Dalmat and Velebich, cruised for the night off the port. Next morning at 3.30 A. M., the whole fleet, including even the Kaiser, which had managed to repair her funnel overnight, had steam up, and was in a condition to proceed to sea; but at break of day the signal-station on Monte Hum reported that the enemy was no longer in sight, and that some smoke, which was at first visible to the west-northwest, at a great distance, soon altogether disappeared. The Italian fleet, indeed, after cruising on and off on the evening of the 20th, had quitted the waters of the island at 10.30 P. M. and made for Ancona, where it arrived on the morning of the 21st. On August 6, owing, it is said, to the damages which she had received in the action, the Affondatore sank during a storm there. The Italian gunboats had been despatched to Manfredonia, in tow of the Washington and the Guiscardo. At 2 P. M. on the 21st, the Austrian Lloyd steamer Venezia, from Zara, reached Lissa, bringing from the Emperor Franz Josef a telegram thanking the officers and men of the fleet and apprising von Tegetthoff of his promotion to the rank of Vice-Admiral. At once he hoisted his flag at the fore, amid general cheering. That evening the dead were buried, the badly wounded were sent off in the Venezia to Spalato and Zara, and the Kaiserin Elisabeth and Dalmat, which had been sent out to look for any Italians who might be still floating near the scene of action, returned bringing only boats and wreckage. At 8.30 P. M. the whole fleet, except the Narenta and the Kerka, which were left under the orders of the commandant of the island, weighed, took up the old wedge-like formation, and put to sea to the northwest. In the evening of the 22d it once more anchored in the roadstead of Fasana.

[A crushing defeat had not been inflicted, and there were no prizes to grace the triumph of the victor; but the remarkable results which, with inferior forces, had been attained, gave the Austrian navy a heritage of splendid tradition, and shed immortal glory on the name of Tegetthoff. The victorious Admiral did not, I think, display qualities of any exceptional brilliancy; for his attacking formation is never likely to be imitated; but he betrayed an intelligent grasp of the ruling principles of naval strategy and a consistent firmness and strength of character which cannot but have favorably influenced all who served under him.]

	Class. I = Iron. W = Wood.	Name of Ship.	Commander. I Capt. = *Linienschiffs-Capitän.* II Capt. = *Fregatten-Capitän.* III Capt. = *Corvetten-Capitän.*		Tons.	Horse power (nominal).	Men.	Guns.					
									24 pounders.		60 pounders.	48 pounders.	30 pounders.	12 pounders.
								Total.	R. B. L.	Shell.	S. B. M.	S. B. M.	R.
1st Division.	W. Ironclad Frigate	Ferdinand Max.	*I Capt.*	Max., *Freiherr* v. Sterneck, *R. Adm.* W. v. Tegetthoff.	5,130	800	480	18	..	..	18	..	..
	W. " "	Habsburg.	"	Carl Faber.	5,130	800	478	18	..	..	18	..	..
	W. " " ...	Kaiser Max.	"	Gustav, *Ritter* v. Gröller.	3,588	650	386	30	14	..	16	..	..
	W. " "	Prinz Eugen.	"	Alfred Barry.	3,538	650	386	30	14	..	16	..	..
	W. " "	Don Juan de Austria.	"	Anton, *Ritter* v. Wiplinger.	3,588	650	386	28	14	..	14	..	..
	W. " "	Drache.	"	Heinrich, *Freiherr* v. Moll.	3,065	500	343	26	16	..	10	..	..
	W. " "	Salamander.	"	Carl Kern.	3,065	500	343	26	16	..	10	..	..
	W. Paddle Aviso.....	Kaiserin Elisabeth.	*II Capt.*	Tobias Oesterreicher.	1,470	350	166	6	2	..	..	..	4
2nd Division.	W. Screw Battleship.....	Kaiser.	*I Capt.*	Anton v. Petz (*Commodore*).	5,194	800	904	22	2	..	..	20	..
	W. Screw Frigate...	Novara.	"	Erik of Klint.	2,497	500	538	51	3	4	..	44	..
	W. " "	Fürst Schwarzenberg.	"	Georg Millosich.	2,514	400	547	46	4	6	..	36	..
	W. " "	Graf Radetzky.	"	Josef v. Aurnhammer.	2,198	300	398	31	3	4	..	24	..
	W. " "	Adria.	*II Capt.*	Adolf Daufalik.	2,198	300	398	31	3	4	..	24	..
	W. " "	Donau.	"	Max. Pittner.	2,198	300	398	31	3	4	..	24	..
	W. Screw Corvette	Erzherzog Friedrich.	"	Marcus Florio.	1,474	230	294	22	2	4	..	16	..
	W. Paddle Aviso.....	Greif.	"	Carl Kronowetter.	1,260	300	102	2	..	..	..	..	2
	W. Lloyd Steamer	Stadium.	*Lieut.*	Victor, *Graf* Wimpffen.	1,400	360	33	..	..	..	..	..	..
3rd Division.	W. Screw Gunboat	Hum.	*II Capt.*	Ludwig Eberle (*senr. off.*).	869	230	139	4	2	..	..	2	..
	W. " "	Dalmat.	*III Capt.*	Wilhelm v. Wickede.	869	230	139	4	2	..	..	2	..
	" "	Wall.	"	Alex. *Graf* Kielmansegge.	852	230	139	4	2	..	..	2	..
	" "	Velebich.	"	Victor Herzfeld.	869	230	139	4	2	..	..	2	..
	" "	Reka.	"	Adolf Nölting.	852	230	139	4	2	..	..	2	..
	W. " "	Seehund.	*II Capt.*	Wilhelm Calafatti.	852	230	139	4	2	..	..	2	..
	" "	Streiter.	"	Rudolf Ungewitter.	852	230	139	4	2	..	..	2	..
	W. Screw Schooner.....	Narenta.	*Lieut.*	Franz Spindler.	501	90	100	6	2	..	..	4	..
	W. " "	Kerka.	"	Gustav Masotti.	501	90	100	6	2	..	..	4	..
	Paddle Aviso	Andreas Hofer.	*III Capt.*	Ulrich William Lund.	770	180	109	4	1	..	..	3	..
					57,344	10,360	7,871	532	115	26	116	269	6

Note.—The elongated shell for the 24 pdr. R. B. L. weighed 64 lbs.; the steel ball for the 48 pdr. S. B. M., 55 lbs.; the shell for the 60 pdr. gun, 47½ lbs.; the ball for the 30 pdr. S. B. M., 32¾ lbs., and the shell for the 30 pdr. S. B. M., 24¾ lbs.

Class. I = Iron. W = Wood.	Name of Ship.	Commander. *I Capt.* = *Capitano di vascello.* *II Capt.* = *Capitano di fregata.*	Tons.	Horse power (nominal).	Men.	Guns. Total.	10 inches. Armstrong steel R.	8 inches. Armstrong steel R.	8 inches. Hooped R.	7 inches. R.	8 inches. S. B. M.	9 inches. Howitzer.	7 inches. S. B. M.	4.7 inches. R.
W. Ironclad Frigate.....	Re d'Italia.	*I Capt.* *Conte* Faa di Bruno, Adm. Persano.	5,700	800	600	36	..	2	16	14	4	..	..	..
W. " "	Re di Portogallo.	" *Caval.* Ribotti.	5,700	800	550	38	2	..	12	14	..	..	..	..
I. " "	Ancona.	" " Piola.	4,250	700	484	27	..	..	22	1	4	..	..	..
I. " "	Maria Pia.	" *Marchese* del Carretto.	4,250	700	484	26	..	..	18	4	4	..	..	..
I. " "	Castelfidardo.	" *Caval.* Cacace.	4,250	700	484	27	..	..	22	1	4	..	..	..
I. " "	San Martino.	" " Roberti.	4,250	700	484	26	..	..	16	6	4	..	1	..
W. " "	Principe de Carignano.	" " Jauch, Rear-Adm. Vacca.	4,086	600	440	22	..	..	12	6	4	..	..	..
I. Ironclad Turretship.	Affondatore.	" " Martini.	4,070	700	290	2	2	..	..	..	..	..	..	..
I. Ironclad Corvette....	Terribile.	" *Barone* de Cosa.	2,700	400	356	20	..	..	10	6	4	..	..	..
I. " "	Formidabile.	*II Capt.* *Caval.* di Saint-Bon.	2,700	400	356	20	..	..	10	6	4	..	..	..
I. " "	Palestro.	" " Capellini.	2,000	300	250	5	..	2	..	..	2	..	..	1
I. " "	Varese.	" " Fincati.	2,000	300	250	4	..	2	2	..	..	..	..	..
W. Screw Frigate.....	Duca di Genova.	*I Capt.* " di Clavesana.	3,515	600	580	50	..	..	..	8	..	10	22	..
W. " "	Carlo Alberto.	*II Capt.* " Pucci.	3,200	400	580	50	..	..	..	8	..	10	22	..
W. " "	Vittorio Emmanuele.	*I Capt.* *Duca.* Imbert.	3,415	500	580	50	..	..	..	8	..	10	22	..
W. " "	Garibaldi.	" " R. Vitagliano.	3,680	450	580	54	..	..	..	8	..	12	34	..
W. " "	Principe Umberto.	" *Barone* Guglielmo Acton.	3,501	600	580	50	..	..	..	8	..	10	22	..
W. " "	Gaeta.	" *Caval.* Cerruti.	3,980	450	580	54	..	..	..	8	..	12	34	..
W. " "	Maria Adelaide.	" " di Monale, Vice-Adm. *Conte* Albini.	3,459	600	550	32	..	..	..	10	22	..	..	..
W. Screw Corvette	San Giovanni.	*II Capt.* " Burrone Lercari.	1,780	220	345	20	..	..	..	6	..	..	14	..
W. Paddle Corvette	Governolo.	" " Gogola.	1,700	450	260	10	..	..	..	..	..	10	..	..
W. " "	Guiscardo.	" " Pepi.	1,400	300	190	6	..	..	..	2	..	..	4	..
W. " "	Eltore Fieramosca.	" " Baldissarotto.	1,400	300	190	6	..	..	..	2	..	..	4	..
Screw Gunboat	Montebello.	" " Sandri.	262	60	63	4	..	..	..	..	..	..	..	4
" "	Vinzaglio.	" " Foscolo.	262	60	63	4	..	..	..	..	..	..	..	4
" "	Confienza.	*Lieut.* " A. Conti.	262	60	63	4	..	..	..	..	..	..	..	4
Paddle Aviso.....	Messaggriere.	*II Capt.* " Giribaldi.	1,000	350	108	2	..	..	..	..	..	..	..	2
W. " "	Esploratore.	" " Orengo.	1,000	350	108	2	..	..	..	..	..	..	..	2
" "	Giglio.	*Lieut.* Denigri.	250	60	26	..	..	..	..	..	..	..	..	..
Hired Paddle Aviso..	Flavio Gioia.	" Moro.	2,000	350	108	..	..	..	..	..	..	..	..	..
" " ..	Stella d'Italia.	" Berlingieri.	2,000	350	108	..	..	..	..	..	..	..	..	..
Paddle Storeship	Indipendenza.	" Liparacchi.	600	300	98	2	..	..	..	..	..	..	..	..
Screw Hospital Ship.	Washington.	" Ziccavo.	1,400	250	98	2	..	..	..	..	..	..	..	..
Hired Paddle Vessel.	Piemonte.	?	?	?	?	..	..	..	..	..	..	..	..	..
			86,029	14,160	10,886	645	4	6	140	128	56	74	218	17

NOTE.—The elongated projectile for the 10 in. gun weighed 385 lbs.; the elongated projectile for the 8 in. Armstrong gun, 147 lbs.; the steel bolt for the 7 in. R. gun, 107 lbs.; the elongated shell for the 7 in. R. gun, 74 lbs., and the steel ball for the 5 in. S. B. M., 34 lbs.

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A USEFUL LITTLE CHANGE IN THE PELORUS.

By Lieut.-Commander Bradley A. Fiske, U. S. N.

When navigating the Petrel among the little straits and bays and rivers that skirt the coast of Asia, I devised a little change in the Pelorus, that seemed to me to improve it greatly. The change was so slight in construction, and made the instrument so much easier to handle, that I have intended for some time to mention it in print, but have been deterred by the fear that the plan is old. I have been unable to find that it is old, however; and so I feel emboldened to mention it, hoping that it may be of use to some.

The reason for making the change, was that it was found very hard to use the ordinary Pelorus quickly enough, when doing such things as entering the Yangtse, where currents are very strong and shoals numerous, and the ship was yawing from side to side. To attempt to take three bearings close enough together, was extremely difficult, if the ordinary method was employed of clamping the Pelorus on the ship's course, and waiting each time till the ship got on it. And we found the other plan of noting the number of degrees by which the ship was off the course, and applying it to the bearing by the Pelorus, gave too much chance of making mistakes.

So the clamp was removed from the Pelorus, and the sight vanes and their connecting bar raised about 1/8 inch, soldering brass strips of this thickness under the ends of the bar, so that the bar rested on the outer or stationery circle. The weight of the bar and vanes was sufficient to hold them at any place where they were put, in taking a bearing. Then the graduated plate was raised about 1/16 inch, by putting a washer of this thickness

under its center. The result of this was, that the graduated plate could be moved around very quickly by the finger.

Suppose now that it was wanted to get three bearings very quickly, on—say a light ship, a lighthouse and a beacon.

The quartermaster was stationed at the compass, and told to sing out the direction of the ship's head, when the officer taking the bearing called " Mark." When ready, the officer sighted the vanes on the light ship, and called " Mark." The vanes stayed where put, the quartermaster sang out—say " North," the officer set the graduated plate instantly at North, and noted the graduation (compass bearing) under the vanes. Then he sighted the vanes on the lighthouse, and called out " Mark." Suppose the quartermaster then reported " North 3° E." The inner circle was instantly moved to that point, and the bearing under the vanes noted. Then the vanes were sighted on the beacon, and the same process repeated.

This plan was used probably a nundred times under conditions of very quick motion, strong currents and narrow channels.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

LETTER FROM THE SENIOR SQUADRON COMMANDER U. S. NAVAL FORCE ON ASIATIC STATION.

FLAGSHIP KENTUCKY.

Cavite, P. I., April 13, 1901.

Sir:—There appears on page 638 of the PROCEEDINGS OF THE U. S. NAVAL INSTITUTE, No. 96, the following paragraph in the article entitled "Operations in North China," by Lieutenant W. C. Davidson:

"Later, on the 14th of June, a force of about 800 allied troops, which had been landed at Tongku, were peremptorily ordered to return to their ships by the Chinese general commanding the Taku forts at the mouth of the Pei Ho. At this, the foreign naval commanders held a conference, at which, the American admiral dissenting, it was decided to take possession of the forts, in order to avoid further trouble with them, and an ultimatum was accordingly sent to the Chinese general on the 15th, demanding that he evacuate the forts before 2 A. M. of the following day."

As this statement, coming from an American naval officer who served in North China, although not until after the capture of the Taku forts, and published by the U. S. Naval Institute, would seem to carry with it a certain weight of authority, and consequently mislead many people in regard to the true history of events, which caused a rupture with the Chinese Imperial troops, I cannot allow it to pass without calling attention to the great error this officer has made in the reason he gives for the ultimatum being sent by the foreign naval commanders to the Chinese general commanding the Taku forts.

On no occasion did any Chinese official order troops of the

allied forces to return to their ships, or even make a protest or offer objection to their landing.

On the other hand, the Russians and the Germans, June 15, prevented a force of Chinese troops from going from Lutai by train to Tongku and Chin Liang Cheng, by the former seizing the railroad station at Tientsin and Chin Liang Cheng, and the latter prohibiting trains from leaving Tongku. The telegram from the Chinese to the station-master at Tongku, ordering a train sent to Lutai, for the purpose of conveying Chinese troops from there to Tongku and Chin Liang Cheng, was obtained and read by Lieutenant Blue, who was stationed at Tongku at the time, as well as a similar telegram, countermanding the order for the train, after the action taken by the Russians and the Germans.

This matter is only referred to in this connection, as it might possibly be this case that Lieutenant Davidson, who arrived about two weeks subsequently, confused in his statement about 800 of the allied troops being peremptorily ordered back to their ships.

Very respectfully,

JAMES KEMPFF,

Rear-Admiral, U. S. Navy, Senior Squadron Commander.

The Secretary of the Naval Institute,
Annapolis, Md.

DISCUSSION.

"Our New Battleships and Armored Cruisers." See No. 96.

Lieut. W. L. Rodgers, U. S. N.—After describing the contrasting features of the Virginia and Maryland, Mr. Taylor's paper concludes by asking the service several questions in regard to the choice of types.

These questions can be answered only after coming to some conclusions as to the tactical value of each increment of one knot's speed. Or in other words, we must have an approximate idea as to what weight of gun-fire is the equivalent of one knot of speed. The subject is thus to be regarded from a tactical standpoint.

I shall make three or four tactical premises from which and from the data on design given by Mr. Taylor, I shall endeavor to draw some conclusion as to the highest speed necessary for battleships. Of course, if the tactical premises are in any degree erroneous, the conclusions are proportionately valueless; but if by discussion and comparison of views we can ascertain that certain tactical ideas are generally acceptable, then I think we may trust our deductions based upon them as to proper speed.

It seems clear that between two hostile ships or squadrons similarly armed and protected which are manœuvring for effective position for the best use of their weapons; the advantage of one knot's superiority of speed becomes less as the speeds become higher; for the reason that each adversary can move more quickly to escape from a position of tactical inferiority.

Moreover, the more quickly the vessels move, the more difficult it will be for a captain or admiral to perceive and seize the fleeting opportunities which offer themselves for the proper employment of the advantages which undoubtedly lie in superior speed.

It must also be remarked that each successive knot of speed requires an ever increasing sacrifice in the weights devoted to battery, ammunition and armor.

Another important point is that the more equally the fire of the battery commands all points of the horizon, the less tactical advantage is conferred by a given superiority of speed; since change of relative position entails less relative change in effective gun-fire. The difficulty is thus to decide upon the approximate speed at which the tactical superiority of manœuvre conferred by an increment of speed is counterbalanced by the necessary sacrifice in the weight of broadside and protection.

Let us take the Virginia as a standard and ascertain approximately what changes in her armament correspond to variations in her speed.

Mr. Taylor states that her machinery weighs 1800 tons; develops 19000 H. P., and gives 19 knots speed. His figure 4 shows the H. P. necessary for reduced speeds of the Virginia and Maryland. He mentions also the greater weight of hull in the Maryland on account of her greater length. From these data I have made up the following table which

roughly shows the weights available for combatant purposes corresponding to variations in the maximum speed.

	1	2	3	4	5	6	7
	Ship.	Maximum speed. Knots.	Displacement. Tons.	Machinery Weights. Tons.	Armor, Battery, Ammunition. Weights. Tons.	Armor, Battery, Ammunition. Percentage of weights of Virginia.	Relative efficiency of armament compared to that of Virginia.
1	Modified Virginia.	13	14,600	395	6217	129	149
2	" "	14	"	485	6127	127	145
3	" "	15	"	610	6000	124	141
4	" "	16	"	755	5857	121	136
5	" "	17	"	970	5643	118	130
6	" "	18	"	1260	5353	110	120
7	Virginia.....	19	"	1796	4817	100	100
8	Modified Virginia.	20	"	1950	4370	90	84
9	" "	21	"	2100	3900	80	66
10	" "	22	"	2265	3400	69	45
	No. 10 is enlarged Maryland.						

The figures in column 7 marked "relative efficiency of armament" are based on those in column 6 and on the assumption that the general fighting efficiency of guns and protection will vary in a greater ratio than that of the weights actually devoted to the whole system adopted. Although the figures in column 7 are somewhat conjectural representing only an individual's opinion, yet figures lend themselves for comparison readily; and we have a convenient approximate scale to compare a little later, the tactical value of different maximum speeds.

From a tactical standpoint superior speed may confer on a combatant a relative advantage of position with regard to the use of each of the three arms, gun, ram and torpedo.

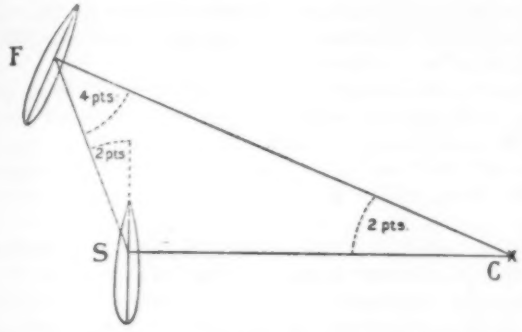
With regard to gun-fire superior speed coupled with superior target practice enables a ship to hold that range at which the superior skill is most effective. Equal speed will prevent the enemy from closing. If one needs speed to close, it is because the shooting is inferior at long ranges, and it would be better to devote efforts to target practice before the war, rather than build with a high speed to make up for defects in drill.

Superior speed may also be used to occupy and endeavor to hold a position such that the maximum gun-fire of one vessel is opposed to the minimum of the other. This problem merits examination.

Let us consider two ships of the usual battery of our service consisting of two heavy turrets on the midship line, some eight-inch turrets and a broadside battery of 5-inch or 6-inch guns, such as the Indiana, Kentucky

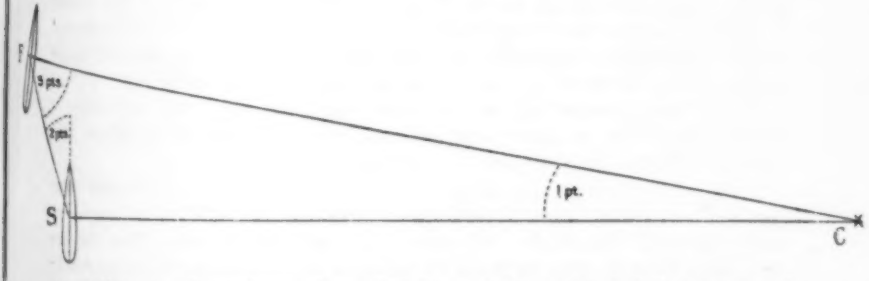
and Virginia. In all these ships the maximum fire covers eight points on each broadside; four points forward and four abaft the beam.

In all, the minimum fire is about two points on each bow and greater and, except in the Kentucky, there is a heavier fire fore and aft than in a direction two points from that line. In none does the minimum fire vary much from 60 per cent of the maximum.



The diagram represents a situation where F (the fast ship) brings her whole broadside against S's least fire. This situation may be maintained by F if both ships circle about the point C. With speeds proportional to their distances from C. Or it may be maintained if F shifts her helm so as to follow a wave line course ahead of S. The latter plan would interfere with the fire of the six-inch battery as regards rapidity.

In the first case the speeds must be as 13 to 10 for F to maintain his superiority. Any less difference will be useless to F; more will be superfluous. If the arrangement of battery of F is altered so as to allow her to cover ten points on each beam with her maximum fire instead of eight points it appears by reconstructing the diagram that a superiority of 10 per cent of speed will do as much for as 30 per cent would do with



a smaller arc of maximum fire. But it must be recollected that a turn of the helm on the part of S will bring his maximum fire to bear, so that while a superiority of 13 to 10 in speed is the least that can be useful to F, the possibility of employing it effectively depends almost entirely

upon S, and upon his committing most unlikely errors in judgment. Turning to column 7 of the table, and taking 15 knots as the speed of S and 20 knots as the speed of F, these being in the ratio of 10 to 13; we find that 60 per cent of the efficiency of fire of S is equal to the whole efficiency of F. If the data and arguments on which the table is based are reasonable, it appears from it that under the circumstances most favorable to speed it will be impossible that a battleship faster than 15 knots shall compensate in action by her speed for her sacrifice of guns and protection. This statement does not mean that 15 knots should be the limiting speed for battleships.

For the use of the torpedo between battleships little is to be gained by high speed; because although it may be used to attempt to gain a position of advantage the slow ship has only to turn so as to bring her adversary abaft the beam when her own torpedoes are more favorably situated than those of the fast ship in case the latter persists in his approach.

For ramming, superior speed is essential, because a position suitable for a ram attack must be occupied before actually committing oneself to it. That is, the vessel about to ram must be so placed before attempting it as to make it almost impossible for the enemy to turn stem to stem, and so to collide with equal chances and fortuitous result. Thus favorable positions for ramming are mostly abaft the opponent's beam and so superior speed is necessary in order to reach him.

Let us assume that a superiority of five knots is necessary to strike an effective blow from astern. Let us also assume that the extreme range for effective shooting is 5000 yards. If then, a vessel tries to ram a battleships the latter will have half an hour in which to disable the former while she tries to approach from astern.

To get some idea as to the time—effectiveness of gun-fire, let us consider the battle of Santiago. In this action, an hour of firing destroyed the Spanish fleet at ranges which were never short and with shooting which seems not to have been good. The efficiency of armament of the Indiana considering her date of design and other features is probably about 75 per cent of that of the Virginia. From the results of the battle it seems probable that a superiority of 60 in column 7 of the table would enable a battleship to destroy her adversary by gun-fire in the half hour necessary for the latter to advance from 5000 yards to collision.

Under these conditions we see from the table that the necessary 5 knots' superiority in speed will cost too much in armament when the slow vessel's speed is as high as 16 knots.

If the above line of reasoning is even approximately correct, our new battleships have a much higher speed than can be utilized in battle to obtain tactical advantage. We must not conclude therefore that fifteen or sixteen knots is sufficient; for we must recollect that speed is a strategic factor, and when superior it confers the ability to force or refuse a battle, and to escape when defeated. But as battleships are not built to run away, but are meant for fighting, I think a speed barely equal to that of other navies is quite enough. Examples from history show that for

attack a fleet is as fast as its fastest ships; yet for retreat it is no faster than its slowest ship.

So if our battle fleet is slightly inferior in speed to our adversary the latter will never be able to get away without fighting, if once it is sighted. The fact that if our ship tries to escape it may lack speed to do so, is not to be considered in battleship design.

Logically, the fastest battleships should belong to that country whose political situation requires it to maintain the most powerful navy. In this way it can always be sure of the battle which its strength causes it to desire.

As foreign battleships are now making 19 knots, I think 18 knots is enough for us. Let us make sure of heavy batteries and well trained crews, and then try to make up the difference in trial speed by assiduous care of the machinery.

If we look at the table to compare an 18 knot with a 19 knot Virginia, we see that the latter would have an advantage of over 500 tons in available weights for guns and armor. By doing away with the 6-inch battery, an 18 knot ship might be designed to carry four 12-inch guns in two turrets, four 8-inch turrets like the Indiana, two superposed 8-inch turrets like the Kentucky and eight 8-inch guns in broadside casemates, making a main battery of four 12-inch and 20 8-inch guns. If the difficulties in ammunition supply are not too great for solution, this battery would be the heaviest afloat, and to my mind it is a feature cheaply purchased by the loss of only a knot in speed.

PROFESSIONAL NOTES.

Prepared by Lieutenant L. S. Van Duzer, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

AUSTRIA.

Arpad and Babenberg.—The other two battleships of the Habsburg class are to be called the Arpad and Babenberg.

Danube Flotilla.—The present Danube flotilla, consisting of four small river monitors, is regarded as insufficient and it is proposed to build two more, if possible to secure the approval of the Imperial Parliament.

Personnel of the Navy.—The enlisted force of the Austrian Navy consists of 22,119 men divided racially as follows: Germans, 3049; Magyars, 1373; Czechs, 1463; Slovacks, 119; Poles, 463; Slavs, 523; Servo-Croats, 8721; Bulgarians, 12; Roumanians, 30; Italians, 6263. The nationality of the others is not reported.

COLOMBIA.

It is reported that the large steel steam yacht Namouna has been sold to the Colombian government by her owner, James Gordon Bennett of the *New York Herald*, and will be converted into a lightly armed cruiser.

DENMARK.

Herluf Trolle: Trial, Description.—This third class, low-freeboard, battleship has completed her trials. The maximum speed was 15.65 knots with 4399 I. H. P.; the mean speed on trial was 14.6 knots and the mean horsepower 3170.

The keel of this vessel was laid on the royal dockyard, Copenhagen, in 1896, and she was launched September 2, 1899. The hull is of steel without sheathing. The freeboard is low, the main deck being only about three feet above water. Forward, a bow superstructure extends from the stem to the forward turret, the forward turret gun being highly placed so as to fire over it. Between the turrets there is a central superstructure not quite as wide as the upper deck. There are two masts, each carrying one military top. The complement is 250 men.

Armament.—Two 9.4-inch guns in closed, balanced turrets, one forward, one aft. Four 5.9-inch guns on the main deck in armored casemates in the corners of the central superstructure. Ten 6-pounders: three each side on the superstructure; and two each side in the superstructure between the 5.9-inch casemates. Eight smaller guns. Three submerged torpedo tubes: one beneath the ram and one training tube on each beam.

Protection.—Nearly complete belt, 7 feet wide, and 261.4 feet long, ex-

tending from the stern to within ten feet of the bow where it ends in a vertical, transverse bulkhead 6.9 inches thick. The belt extends from 3.6 feet below water to the main deck and is 6.9 to 7.9 inches thick. The armor deck over the belt is flat and 2.24 inches thick; beyond the belt a submerged protective deck extends to the stem. The casemate armor is 5.9 inches thick in front and 2.56 inches in rear. The turrets are 6.9 inches thick in front and 5.9 inches in rear and rest on barbettes, 6.9 inches thick, rising a foot or so above the armor deck. The conning-tower is 7.9 inches thick in addition to an inner skin 1.1 inches thick. The armor of the belt, turrets, and conning-tower is of chrome-nickel steel.

Motive power.—Twin-screw, triple-expansion engines, designed to develop 4200 I. H. P. and give a speed of 15 knots. There is one smoke-pipe.

Dimensions.—Length between perpendiculars, 271.9 feet; beam, extreme, at waterline, 49.5 feet; normal draught, 16 feet forward and aft; displacement at this draught, 4200 tons.

ECUADOR.

GUNBOATS PURCHASED.—It is reported that the Ecuadorian government has purchased the old French gunboats Papin and Inconstant. These two vessels are composite built and have been condemned as not worth repair, partly because of age and condition and partly because of their design being unsuited to present requirements. They are sister ships and have the following dimensions: Length, 199.5 feet; beam, 23.4 feet; mean draft, 12.75 feet; displacement, 811 tons. The armament consists of two 5.5-inch breech-loading guns of old type; one 3.9-inch gun of similar type; and five 37-mm. revolving cannon. The engines are single-screw, horizontal, compound; boilers, 6, each with one furnace. Horsepower about 860 and speed when new, 12 knots. The coal capacity is about 150 tons.

FRANCE.

BUDGET FOR 1902.—The budget for 1902 as submitted to the Chambers calls for an expenditure of 340,508,183 francs ($65,718,079.32—1 franc = $0.193), an increase of 12,815,553 francs over that of 1901. As it has not yet been approved by the Chambers it is useless to mention details.

PROPOSED INCREASE OF LISTS OF OFFICERS.—The proposed changes are shown in the following table:

	Present list.	Proposed list.
Vice-admirals	15	15
Rear-admirals	30	30
Captains (capitaines de vaisseau)	125	125
Commanders (capitaines de frégate)	215	215
Lieutenent-commanders (capitaines de corvette)	—	150
Lieutenants (lieutenants de vaisseau)	754	870
Ensigns (enseignes de vaisseau) / Midshipmen of first class	599	700
Total	1738	2105

	Present list.	Proposed list.
Mécanicien inspecteur général	1	—
Inspector général mécanicien (vice-admiral)	—	1
Mécanicien inspecteurs	6	—
Directeurs du service des machines (contre-amiraux)	—	2
Mécaniciens en chef	20	—
Mécaniciens en chef de 1re classe (cap. de vaisseau)	—	6
Mécaniciens en chef de 2e classe (cap. de frégate)	—	15
Mécaniciens principaux (capitaines de corvette)	—	30
Mécaniciens principaux de 1re classe	100	——
Officiers mécaniciens de 1re classe (lieutenant de vaisseau)	——	170
Mécaniciens principaux de 2e classe	200	——
Officiers mecaniciens de 2e classe (enseignes de vaisseau)	——	270
Total	327	494

The mécaniciens principaux (capitaines de corvette) will be detailed as chief engineers of armorclads, which have engines of 16,000 I. H. P. or more. The mécaniciens en chef de 2e classe, will be assigned as chief engineers of divisions. The mécaniciens en chef de 1re classe will serve as fleet engineers and, with the directeurs du service des machines, in the ports.

New Ships.—The two new battleships which were described in *No. 97*, page 156, are to be called the Republique and the Patrie; the former is to be built at Brest and will be laid down as soon as the Leon Gambetta is launched. As the Gambetta has scarcely been commenced the laying down is not likely to take place till towards the close of 1901. The Victor Hugo, an armored cruiser of the Gambetta class, is to be commenced at Toulon. The ten torpedo-boat destroyers referred to as likely to be built (see page 154, *No. 97*) have all been, or are about to be, ordered. The two under construction at Rochefort are to be called the Francisque and Sabre; the eight which are to be built in private yards have received the names Dard, Baleste, Mousqueton, Arc, Pistolet, Belier, Catapulte, and Bombarde. Two of last year's program, the Mousquet and Javeline, have just been contracted for. The torpedo boats which are to be built in private yards, eleven in number, have all been contracted for. They will have a displacement of 87 tons, a speed of 24 knots, and their numbers are to be 266 to 276 inclusive. Three new submarine boats have been commenced. They are of different types and are not included in the list hitherto provided for, but are designed as experimental boats in which to study various features. Through some oversight the list of submarine boats building in France was omitted from the list of vessels given in *No. 97*, page 154. The list corrected to June 1, is here supplied:

Name. *Morse type.*	Displacement.	Where building.	Remarks.
Français	146	Arsenal, Cherbourg,	Launched Jan. 25, 1901, and undergoing trials.
Algérien	146	" "	Launched April 27.
Farfadet	185	Arsenal, Rochefort,	Launched May 17.
Gnome	185	" "	Building.
Korrigan	185	" "	"
Lutin	185	" "	"

Name.	Displacement.	Where building.	Remarks.
Narval type.			
Sirène	106	Arsenal, Cherbourg,	Launched May 4
Triton	106	" "	Building.
Silure	106	" "	"
Espadon	106	" "	"
New boats.			
Three experimental boats	?	?	Building.
Perle	70	Arsenal, Brest,	Ordered; not begun.
Bonite	70	" "	" "
Esturgeon	70	" "	" "
Thon	70	" "	" "
Souffleur	70	" "	" "
Anguille	70	" "	" "
Aloze	70	" "	" "
Dorade	70	" "	" "
Truite	70	" "	" "
Grondin	70	" "	" "
Four boats	70	Arsenal, Cherbourg,	" "
Six boats	70	Arsenal, Rochefort,	" "

VICTOR HUGO: DESCRIPTION.—This armored cruiser is to be laid down at Toulon during the summer. She is a sister ship to the Leon Gambetta and Jules Ferry now under construction. The complement is 690 men and 38 officers. Her external features may be understood from the illustration facing this page. The principal details are:

Armament.—Four 7.6-inch guns in pairs in turrets forward and aft. Sixteen 6.48-inch guns: twelve in pairs in six turrets, three each side; and four singly in casemates. Twenty-two 3-pounders. Ten machine guns. Two submerged torpedo tubes and three above water tubes.

Protection.—Complete belt, 6.7 inches to 4 inches thick; above this, side armor in the form of another belt, 5 inches to 3 inches thick. The turrets of the 7.6-inch guns are 6 inches thick and have 7.7-inch bases. Small turrets, 5.5 inches. Casemates, 4 inches.

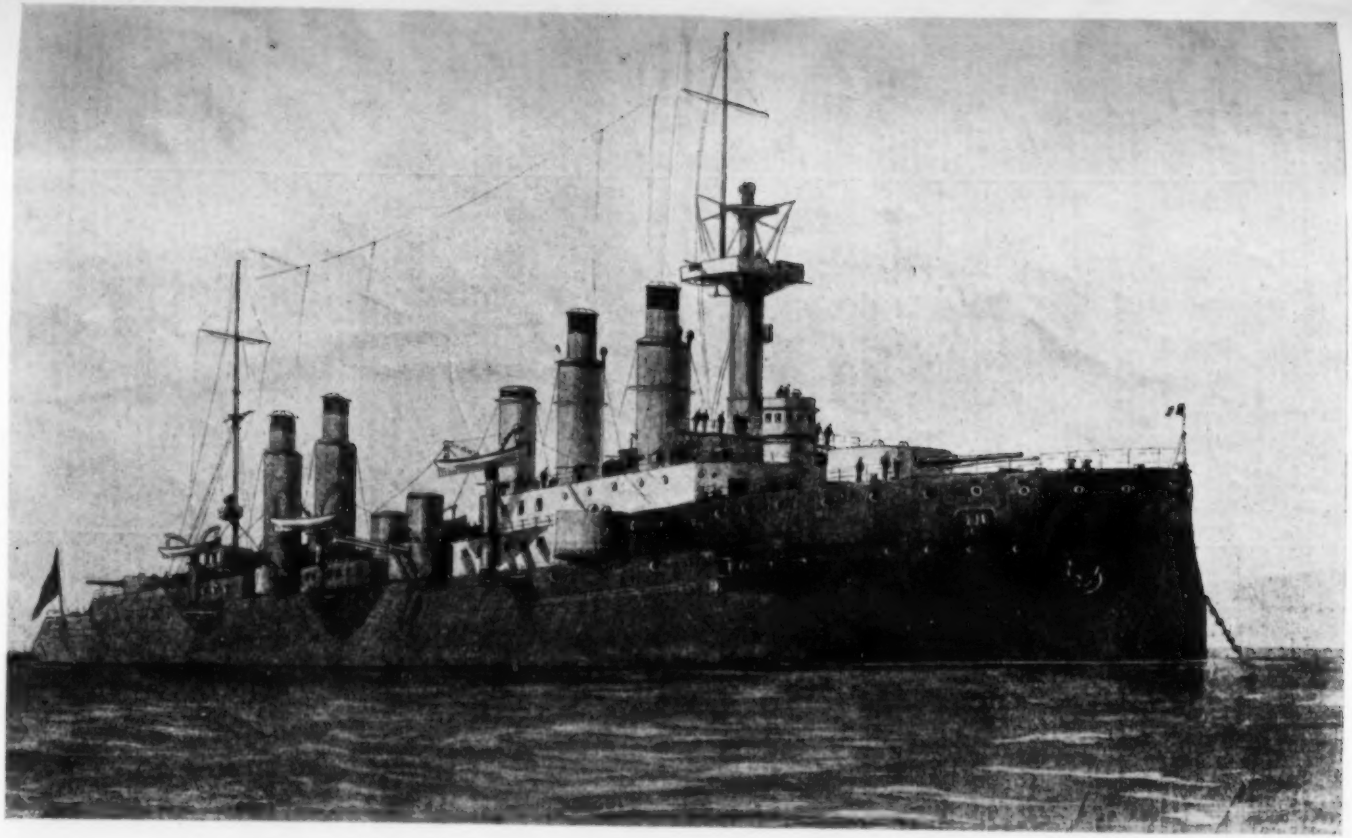
Motive power.—Triple screw engines of 27,500 I. H. P., designed to give a speed of 22 knots (which it most certainly will—probably 23). Boilers, water-tube; type not settled. Coal supply, normal, 1320 tons; total capacity, 2100 tons—the additional 780 tons being in the form of briquettes.

Dimensions.—Length, 480.7 feet; beam, 70.2 feet; draft, 26.25 feet; displacement, 12,500 tons.

DESAIX: LAUNCH, DESCRIPTION.—This armored cruiser is building at the yard of the Société des Ateliers et Chantiers de la Loire, St. Nazaire, where she was launched March 21. She is a sister ship to the Dupleix, launched a year ago, and to the Kléber, still on the ways. The hull is of steel, sheathed with wood and coppered. The principal details are:

Armament.—Eight 6.48-inch guns in pairs in four turrets; one forward, one aft, and one on each side amidships. Four 3.9-inch guns. Ten 3-pounders. Four 1-pounders. Two above-water torpedo tubes.

Protection.—Water-line belt, 4.3 inches thick amidships, extending from the stem to within 65 feet of the stern. It rises 3.3 feet above water and descends 3.9 feet below it; toward the bow it rises 9.8 feet above water. Complete protective deck, 1.77 inches on the flat and 2.76 inches on the slopes. Cofferdam around the water-line just inside the armor, extending the full height of the space between the two decks covered by the



FRENCH ARMORED CRUISER VICTOR HUGO.
From the Engineer.

belt. It is proposed to fill the cofferdam with obturating material. Inboard of the cofferdam is a passage way. On the first deck above the belt there are fitted on each side partial partitions extending inboard from the sides of the vessel, and producing the effect of a number of wide stalls. These are fitted on the Jeanne d'Arc and vessels similar to her, and are made of metal not thicker than 0.08 inch, and have a beading on the inboard edge. They are placed at every fourth beam and extend nearly the entire length of the deck, being discontinued only at the ends, where the sides begin to curve markedly toward the bow and stern. They are intended to localize water in case the vessel should take a marked heel through injury in battle. They are secured inboard to a fore and aft strip about 18 inches in height. Turret armor, 5.5 inches.

Motive power.—Triple-screw engines designed to develop 17,100 horse-power at 150 revolutions and give a speed of 21 knots. Twenty-four Belleville boilers, in eight fire-rooms, with a total grate area of 1076 square feet. Coal supply, normal, 880 tons; total capacity, 1200 tons.

Dimensions.—Length, 426.5 feet; beam, 58.66 feet; mean draft, 22 feet; displacement, 7710 tons (metric).

IÉNA: TRIALS, DESCRIPTION.—This battleship is very similar to the three of the Charlemagne class and differs chiefly in the caliber of her heavy auxiliary guns, in having a nearly straight stem, and in the different arrangement of the upper part of her superstructure and military tops. There are two military masts, each carrying a domelike top—that on the mainmast being placed quite low. A photograph of the ship will be published in these notes as soon as she is fully completed for service. The hull is of steel, without sheathing. The principal details are:

Armament.—Four 12-inch guns in pairs in turrets forward and aft. Eight 6.48-inch guns in central casemate like the lower eight 5.5-inch guns of the Charlemagne, forward four firing directly ahead and after four directly astern. Eight 3.9-inch guns on the superstructure, four each side. Sixteen 3-pounders. Sixteen 1-pounder and light guns. Four torpedo tubes, two of which are submerged.

Protection.—Complete water-line belt, 13.8 inches thick amidships and 5.9 inches at the ends. Secondary belt above this 4.7 inches thick. Two protective decks—upper one 2.5 inches and lower one 0.79 inch—meet the top and bottom edges of the belt at the side and the space between them is closely subdivided. Between the top of the belt and the lower edge of the casemate of the 6.48-inch guns there is an unarmored space about four feet wide. Thickness of turrets, 11.8 inches; of casemate armor, 4.7 inches.

Motive power.—Triple-screw, 4-cylinder, triple-expansion engines designed to develop 15,500 I. H. P. and give a speed of 18 knots at 125 revolutions. Twenty Belleville boilers. Normal coal supply, 820 tons; total capacity for coal, petroleum, and briquettes, 1100 tons. The trials have all been completed except that at full power. The results, as far as attained, are:

Date of trial	Mch. 26	Mch. 31	Apr. —
Number of boilers in use	14	20	20
Duration of trial, hours	6	6	6
I. H. P.	5504	12,500	9830
Speed	13.8	17.4	16.3

She has suffered much from hot bearings, said to be owing to too light construction of the hull. *Le Yacht* says that she is one of the few vessels in the French navy which is floating above her designed water-line, and thus possessing a reserve of displacement.

Dimensions.—Length on water-line, 400.75 feet; beam, 68.37 feet; draft aft, 27.5 feet; displacement, 12,052 tons (metric).

SABRE, FRANCISQUE, DARD, BALESTE, MOUSQUETON, ARC, PISTOLET, BELIER, CATAPULTE, BOMBARDE, MOUSQUET, JAVELINE: DESCRIPTION.—These torpedo-boat destroyers are, or are about to be, ordered. The first two are to be taken in hand at Rochefort without delay and the Mousquet and Javeline, which really belong to last year's program, were recently ordered from the Ateliers et Chantiers de la Loire. The principal dimensions are: length, 183.7 feet; beam, 19.7 feet; draft, 9.35 feet; displacement, a little less than 300 tons. The horsepower of the machinery will be 6300 and the expected speed 28 knots. The hull will be of nickel steel. The armament will consist of one 2.56-inch gun, six 3-pounders, and two torpedo tubes. The cost of the Mousquet and Javeline is 1,450,000 francs each. This description is that furnished for the last-named boats alone, but it is believed to be practically correct for the others.

MISTRAL, SIROCCO, SIMOUN: LAUNCH, DESCRIPTION.—These sea-going torpedo boats of 180 tons have been launched; the Mistral at the works of A. Normand & Co., Havre, May 4; the Sirocco at the same yard February 20; and the Simoun at the Graville (Havre) yard of the Forges et Chantiers de la Méditerranée March 25. They are believed to be similar in all essential respects. The dimensions are: Length, 155.6 feet; beam, 16.1 feet; draft, 8.5 feet; displacement, 180 tons. The engines are twin-screw, vertical, triple-expansion, designed to develop 4200 I. H. P. and give a speed of 26 knots. The armament consists of two 3-pounders and two torpedo tubes.

TORPEDO BOAT NO. 242: LAUNCH.—This torpedo boat of 90 tons, 1800 I. H. P., and 24 knots speed, was launched at the Saigon Arsenal, April 20. It was to have been fitted with turbine motors and six screws, but perhaps the design was changed.

PIQUE, EPÉE: TRIALS.—Torpedo-boat destroyers of 313 tons displacement, designed for a speed of 26 knots with 5700 I. H. P. The Pique's first official trials took place in October last, but as the speed attained was only 24 knots, it was decided that new screws would be necessary before the required speed could be reached. In February she ran a trial of five hours duration, maintaining a speed of 22.25 knots with 268 revolutions of her engines, and for one hour a speed of 25.58 knots with 298 revolutions. The latter trial was interrupted on account of a hot guide, but she made another attempt in March, reaching 25.5 knots with 297 revolutions.

The Epée has had preliminary trials during which she reached a speed of 25.621 knots. Subsequently she made 19.15 knots with one group of boilers in use.

ALGÉRIEN: LAUNCH.—The submarine boat Algérien, a sister to the Français (partly described on page 157, PROCEEDINGS *No.* 97), was launched at the arsenal, Cherbourg, April 27. The armament consists of a torpedo tube forward and a launching apparatus on each side. The cost is 760,000 francs.

SIRÈNE: LAUNCH, DESCRIPTION.—This submarine boat of the submergible type was launched at Cherbourg on May 4. She is the first of four to take the water; and her sisters, the Triton, Silure, and Espador, will follow shortly. This model is a development of the Narval type which it resembles closely. The Narval, as we know, consists of a tube—or fusiform shell—which forms the boat proper, and is strong enough to resist the pressure at very considerable depths. Surrounding this there is a second shell closely resembling in form the hull of an ordinary surface torpedo boat, but with fewer projections and irregularities in contour. The space between the two hulls is used for water ballast and when fully submerged is sufficiently open to the sea so that the external pressure is transmitted to the interior hull, while the exterior hull is kept without strain. The defects of the system as exemplified in the Narval are that the means of admitting water evenly and steadily are not sufficiently rapid and the submerging is further delayed by the change from steam propulsion to electric. The defects herein referred to render it impossible to submerge the Narval in less than 15 or 20 minutes—a wholly impermissible interval—but the new boats are expected to do better.

The Sirène has the following dimensions: Length, 111.55 feet; beam, 12.3 feet; draft when moving on the surface, 5.25 feet; displacement in this condition, 106 tons. The appearance when running on the surface is that of a rather low torpedo boat with vertical sides; a flat and very clear deck is slightly rounded at the sides to meet the side plating. A further description of the exterior is dispensed with as it is hoped to present the latest photographs of the Narval and other submarine boats in the next number of the PROCEEDINGS. The propelling machinery consists of a vertical, triple-expansion engine of 217 I. H. P., supplied with steam by a water-tube boiler, and gives a speed of 10 to 12 knots when running as an ordinary surface boat. In this condition the boat can charge the accumulators which she uses when running submerged. The radius of action under steam is 400 to 500 miles. The armament consists of four sets of 17.7-inch torpedo launching apparatus.

FARFADET: LAUNCH, DIMENSIONS, ETC.—The submarine boat Farfadet, of the improved Morse type, was launched at Rochefort arsenal on May 17. She was commenced September 27, 1899, and is the first of her class to be launched. The others are the Gnome, Lutin, and Korrigan. The plans are by M. Mangas. The dimensions are: Length, 135.67 feet; beam, 9.5 feet; maximum draft and depth amidships, 9.5 feet; displacement, 185 tons when submerged, and slightly less when running at the surface. Like their prototype, the Morse, the vessels of this class are very long and slender. The speed, either at the surface or submerged, is expected to be about 12 knots. There is a single screw worked by electric power furnished by accumulators which are charged in the port to which the vessel is attached, or by some ship. The radius of action is small—perhaps 50 miles at the most economical speed. There are four sets of apparatus for launching torpedoes. The complement consists of an officer and eight men.

VERON SUBMARINE BOAT.—Experiments were recently conducted at Marseilles, France, with a submarine model, the invention of a boilermaker named Victor Veron, employed in a private shipyard. The inventor was highly complimented by Admiral Besson who witnessed the tests.—*Army & Navy Journal.*

GERMANY.

NEW ARMORED CRUISER.—The new armored cruiser C (ersatz Konig Wilhelm) is to be of 9800 tons instead of 8868, as are the Prinz Heinrich and Cruiser B. The increased tonnage is to be applied to additional protection, engine power, coal, and battery. The latter will consist of four 8.27-inch guns, ten 5.9-inch, and twelve 3.5-inch.

PANTHER: LAUNCH, DESCRIPTION.—The gunboat building at the government yard, Dantzic, was launched April 1 and named the Panther. She is a sister to the Iltis, Jaguar, Tiger, and Luchs. The general characteristics of this vessel are shown in the photograph of the Tiger on the opposite page, which was taken at the Naval Academy, Kiel. The principal characteristics are:

Armament.—Four 3.5-inch guns; eight 1-pounders; two machine guns.

Protection.—Steel watertight deck.

Motive power.—Twin-screw, triple-expansion engines designed to develop 1200 I. H. P. and give a speed of 13 knots. Coal supply, 120 tons; total capacity, 160 tons.

Dimensions.—Length, 203.4 feet; beam, 29.86 feet; mean draft, 10.8 feet; displacement, 899 tons.

FREYA: TRIALS.—The trials of this cruiser have been completed with satisfactory results, the data being:

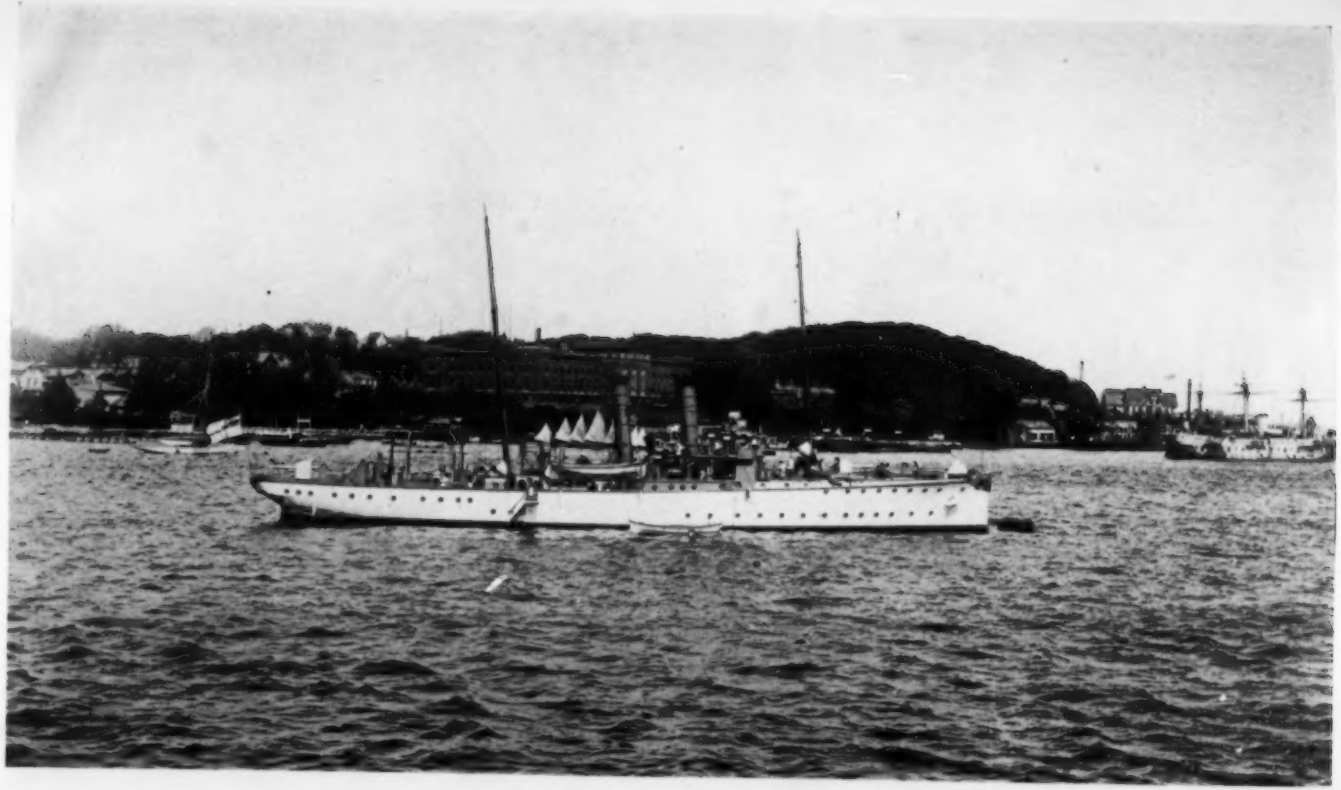
Date	Mch. 21	Mch. 26-27	Mch. 29-30	—
Duration, hours	6	24	24	72
I. H. P.	10,600	1200	6000	6000

All these trials were completed in thirteen days, the last one being at a speed of 16 knots.

The Freya is a cruiser of 5650 tons displacement and of the following dimensions: Length, 344.4 feet; beam, 57 feet; draft, 21.67 feet. She has Niclausse boilers with 775 square feet of grate, and 25,834 of heating surface.—*Journal of the American Society of Naval Engineers.*

KAISER CLASS: DESCRIPTION, REMARKS, ACCIDENT TO KAISER FRIEDRICH III.—The vessels of this class are the Kaiser Wilhelm II, Kaiser Karl der Grosse, Kaiser Friedrich III, Kaiser Wilhelm der Grosse, and Kaiser Barbarossa. All have been launched, but the Kaiser Karl der Grosse and Kaiser Barbarossa may not be ready for service before the end of the year. The complement is 642 officers and men. The general appearance of the class is shown by the illustration on the opposite page. The principal details are:

Armament.—Four 40-caliber, 9.45-inch Krupp guns in pairs in turrets forward and aft. Eighteen 40-caliber, 5.9-inch Krupp guns: six in six small turrets on the upper deck amidships, three each side; two in casemates on the upper deck built up against the forward side of the forward 9.45-inch gun support; four in casemates on the upper deck, one each side abreast each mast; two in casemates on upper deck at after end of superstructure, firing over after 9.45-inch gun turret; two in casemates on main deck, one each side abreast forward 9.45-inch gun turret; two in casemates on main deck, one each side abreast mainmast. Ten 40-caliber, 5.5-inch guns, five each side, on superstructure deck behind shields. Twelve 1-pounders. Six torpedo tubes: one 46-centimeter tube above water in stern; one 53-centimeter submerged tube firing through fore foot; four 46-centimeter submerged tubes in broadside.



GERMAN GUNBOAT TIGER, WITH THE GERMAN NAVAL ACADEMY AT KIEL, IN THE BACKGROUND.

GERMAN BATTLESHIP KAISER FRIEDRICH III.

Protection.—Water-line belt extending from stem to abreast after turret where it sweeps inboard and encloses base of after turret. It is 6.5 feet wide, of which width 2.95 feet is above water at mean load; and its thickness is 11.8 inches amidships and 5.9 inches at the ends. The armor deck above the belt is 2.56 inches thick; below this there is a curved splinter deck 0.8 inch thick. The protective deck abaft the belt is 2.95 inches on the slopes. The turrets for the 9.45-inch guns are 9.8 inches thick and the smaller turrets and casemates 6 inches. The turrets do not rest upon armored barbette towers but are supported by framing and connection is made to the armor deck by armored loading tubes only. There are two conning-towers, the forward one 10 inches thick and the after one 4 inches.

Motive power.—Triple-screw, triple-expansion engines, designed to develop 18,000 I. H. P. and give a speed of 18 knots. The boilers of some of the class are partly cylindrical and partly water-tube; of the others, all water-tube. The coal capacity is 650 tons; in addition to which 229 tons of tar oil may be carried.

Dimensions.—Length between perpendiculars, 377.3 feet; beam, 66.9 feet; mean draft, 23.95 feet; displacement, 11,081 tons.

The particulars of the accident to the Kaiser Friedrich III are given in the following:

Kiel, April 3.—The flagship of Prince Henry of Prussia, the turretship Kaiser Friedrich III, grounded yesterday afternoon east of Arcona, owing to some unexplained cause. She arrived here this afternoon under her own steam and was docked. The damages she has sustained appear to be so extensive that she may have to be put out of commission.

It now appears that the accident was caused by bad steering, the vessel running into the shallows, near Bornholm Island, to approach which is forbidden to warships.

Soon after the battleship went aground a fire broke out from some cause unknown in the engine-room, and it was not quenched until after two hours' fighting, when the room was placed under water. The damage is serious, and several months will be needed for repairs.—*Baltimore American.*

The accident which befell the German battleship, Kaiser Friedrich III, flagship of Prince Henry of Prussia, near the Adlergrund last week, was more serious than was at first supposed, and might, but for the good work of those on board, have ended in a great disaster. The ship was steaming at full speed when she touched the ground, but passed over the obstacle, damaging, however, four of the watertight compartments, which began to fill. The doors were closed and the pumps set in action, while the ship was taken in tow by the Kaiser Wilhelm II, the engines having stopped. Meanwhile it was reported that fire had broken out in some of the bunkers. The shock of the collision had caused leakages in the tanks for storing the *masut*, or heavy residual oil of petroleum which is used for stoking, and this having flooded the stokeholds, these became masses of flame. After strenuous endeavors lasting three hours the fire was subdued, but it had been necessary to admit water to the stokeholds, storerooms, and magazines, and eight of the boilers were damaged. Prince Henry remained with the men directing the operations, and it would appear that at one time the possibility of having to abandon the ship was contemplated. The walls of the flooded compartments began to bulge owing to the pressure within, and had to be propped—an operation of

much danger. The stokers behaved with great gallantry, and the ship was saved. Two men were seriously burned, and the Kaiser Friedrich was badly damaged, but the accident might have resulted far more seriously. As it is, the ship will probably be in hand for repair during the whole of the present year, and the cost of the work is estimated at 3,000,000 marks. The Wilhelm der Grosse will take her place in the squadron. The Wilhelm II also touched the ground and damaged her propellers. —*Army & Navy Gazette*, April 13.

All the information accessible goes to show that the German battleship Kaiser Friedrich III was saved almost by a miracle. The heavy petroleum used for auxiliary stoking was stored in the bilge, and the water which invaded the ship floated it into the stokeholds. The watertight doors were closed, and all attention was devoted to extinguishing the fires and flooding the magazines, which were in danger. The fire was of a very serious nature, the engines and boilers were damaged, and the propellers were injured. It appears not yet to have been fully ascertained why the Kaiser Friedrich and her consort the Kaiser Wilhelm touched the ground to the south of the island of Bornholm. The shoal is the Adlergrund, and an officer was despatched to make a survey of the reefs, some uncharted rocks being discovered in the course of his survey. In ordinary circumstances there is a perfectly safe passage between the island and the mainland. Too much praise cannot be given to the ship's company, who worked with increasing energy to stifle the flames and to keep out the sea. The Emperor has conferred decorations upon Captain Thiele and several officers, engineers and stokers, who at the risk of their lives flooded the magazines. When waterproof sheetings had been lowered over the holes, 1000 tons of water were pumped out of the ship. The squadron was engaged at the time in its summer evolutionary cruise, which always precedes the manœuvres, and was returning from Danzig to Kiel. It had visited Sassintz and Rügen, and the programme includes visits to some foreign ports. The Kaiser Wilhelm der Grosse is to take the place of the Friedrich III.—*Army & Navy Gazette*, April 27.

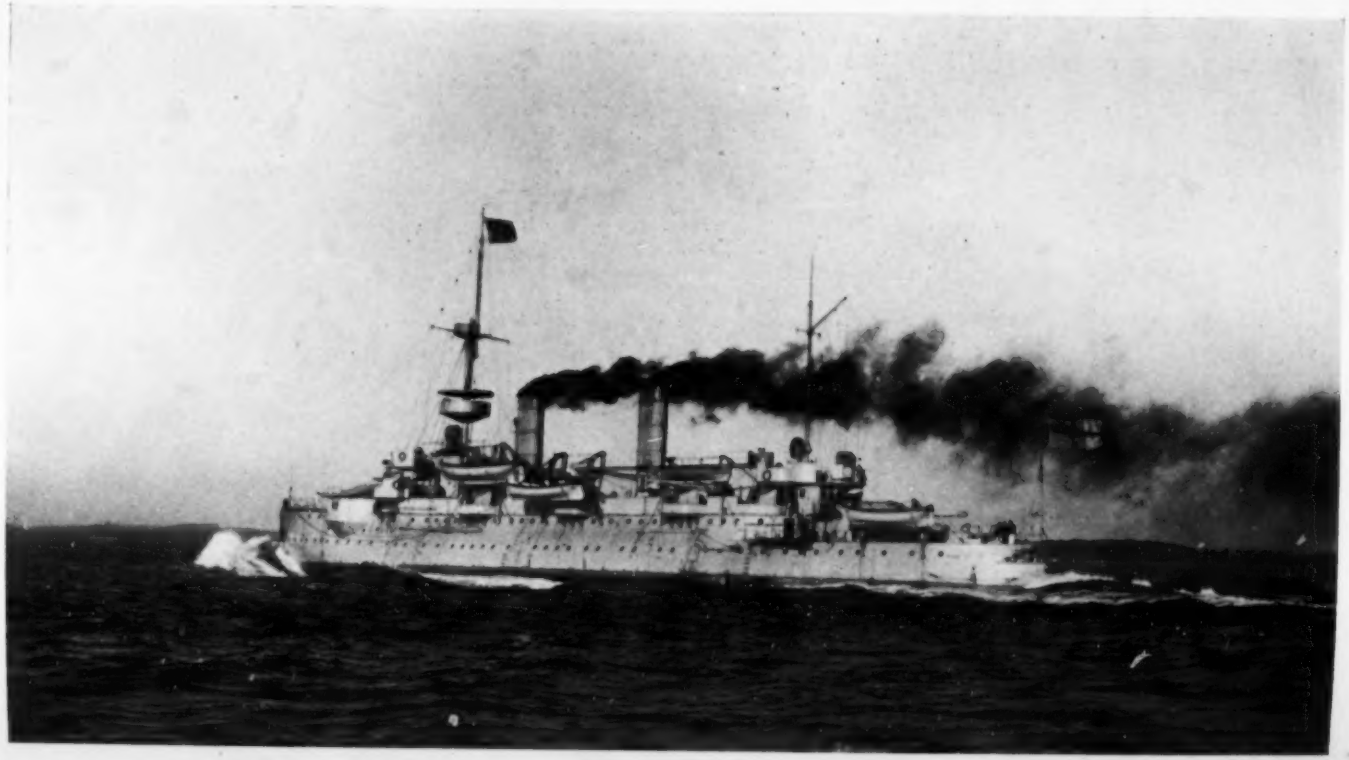
Brandenburg Class: Reconstruction.—The battleships of the Brandenburg class are to be taken in hand for reconstruction. The midship 11-inch guns, mountings, and armor are to be removed and replaced by a battery of 5.9-inch guns protected by armor.

Hagen, Hildebrand, Beowulf, Heimdal: Reconstruction.—The three last named, all of which are of the Siegfried class, will be reconstructed on the same lines as the Hagen, fully described in *No. 97*, page 162. A photograph of the reconstructed Hagen faces this page.

GREAT BRITAIN.

Naval Estimates for 1901-1902.—The total amount of the estimates is £30,875,500 (£1 = $4.8665), an increase of £2,083,600 over the estimates for the preceding year. The Manning Vote (Vote 1) shows an increase of £233,000, due in the main to the increased number of men last year and this year. Vote 8, shipbuilding, etc., shows a net increase of £1,274,900. Vote 9, armaments, is increased by £161,800. Vote 10, works, is increased by £137,300. The remaining Votes show a net increase of £276,600. The comparison in each case is with the original estimates of 1900-1901 plus the additional Estimates voted in July, 1900.

The total number of officers, seamen, and boys, coast guard, and



GERMAN COAST-DEFENCE SHIP HAGEN, AFTER REBUILDING.
From a photograph by A. Renard, Kiel.

marines proposed for the year 1901-1902 is 118,635, being an increase of 3745, as follows: 287 officers, 1150 seamen, 500 stokers, 398 miscellaneous, 310 artisans (including 100 electricians), 1000 marines, 100 apprentices (shipwrights and coopers).

During the year a new arrangement has been made with nearly all the great steamship companies, by which their finest vessels are held at the disposition of the Admiralty for employment as armed cruisers when required. Under the previous agreements only the Cunard, White Star, Peninsular and Oriental, and Canadian Pacific Companies were included. To these have now been added the Orient, Royal Mail, and Pacific Companies. Eighteen of the largest and swiftest passenger steamers belonging to these companies will receive an annual subvention, and thirty steamers in addition are held at the disposition of the Admiralty without further subsidy. In the main features the new agreements will be similar to former agreements, but in some particulars modifications have been made which are based on experience.

Five submarine vessels of the type invented by Mr. Holland have been ordered, the first of which should be delivered next autumn.

It is proposed to lay down in the financial year 1901-1902 the following vessels: 3 battleships, 6 armored cruisers, 2 third-class cruisers, 10 torpedo-boat destroyers, 5 torpedo boats, 2 sloops, 5 submarine boats (ordered and work commenced in 1900). Of these, 2 battleships, 1 armored cruiser, and 2 sloops will be built in the royal dockyards, and the rest by contract.

"The total vote proposed for new construction is £9,003,256, of which £8,465,406 will be devoted to pushing forward the ships already in hand to the utmost of our power and to work on the submarine boats, and £537,850 to starting work on the additional ships to be commenced. The object aimed at in this distribution of the money is to advance the work on the many ships now under construction as far as possible towards completion, and to place the ships to be newly commenced into such a position that the utmost possible amount of work can be put into them in 1902-3."

The amount required under the naval ordnance vote is larger than the original vote for 1900-01 by £915,000. An additional estimate of £753,200 was, however, taken under this vote during the year, so the net increase over 1900-01 is £161,800. A sum of £420,000 is included in the estimate in practical completion of the policy of increasing the reserves of guns and ammunition. Provision is also included for the continuation of the issue of armor-piercing shell to the fleet. Deliveries of the new design of the 12-inch B. L. wire gun have been made, and these guns are now mounted in the battleships of the Formidable class. Some delay has occurred in the completion of the new 9.2-inch B. L. guns, as the trial of the first gun showed that a slight modification of design was necessary. Deliveries are, however, now being made, the first two guns having been mounted in the Cressy, and it is hoped that the guns for succeeding ships will be ready by the time they are required. A new gun of 7.5-inch caliber has been tried satisfactorily, and has been approved. A 5-inch B. L. gun has been converted to take the Welin breech screw, and the design has been approved. Progress is being made each year with the rearmament of the fleet with .303-inch Maxims in lieu of the older patterns of machine guns. Telescopic sights have been adopted for Q. F. guns, and the supply is proceeding. A new design of mounting for the 9.2-inch gun

has been tried during the past year with very satisfactory results. As a result of experience gained in South Africa and China some modifications and additions are being made to the seamen's equipment for service on shore. Wireless telegraph apparatus has been obtained and supplied to a certain number of ships at home and abroad.—From the *Statement* of the First Lord of the Admiralty.

NEW 18,000-TON BATTLESHIPS.—It is reported that the battleships of the new program will be of 18,000 tons. Neither names nor details are yet settled.

QUEEN, PRINCE OF WALES: KEELS LAID, DESCRIPTION.—The keel of the Queen was laid at Devonport dockyard, March 12, and that of the Prince of Wales at Chatham, March 20. These vessels are described in the current Naval Annual as follows:

"Their dimensions are: Length, 400 feet; breadth, 75 feet; mean load draft, 26 feet 9 inches; displacement, 15,000 tons. The armor will include a steel belt, commencing about 30 feet from the bow and running a distance of 220 feet towards the after part of the ship. This belt will be 15 feet deep and of 9-inch armor plates. There will be a curved, transverse bulkhead, near the after barbette, made of 12-inch armor plates, while the barbettes themselves will be built of plates varying from 6 in. to 12 in. thick. A protective deck covering the vital parts has been provided for, this being of the turtle-back shape, having a thickness of 1 inch on the flat and 2 inches on the slopes. The barbette hoods will be of 8-inch and 10-inch armor, and the casemates for the 7-inch and 6-inch guns will consist of 6-inch plates. The armament will comprise four 12-inch, 50-ton, wire-wound, breech-loading guns, mounted in pairs in two barbettes —one forward and the other aft; eight 7.5-inch modified Q. F. guns of a new type; eight or ten 6-inch Q. F. guns; sixteen 12-pounders (12 cwt.), and two 12-pounders (8 cwt.); six 3-pounder Hotchkiss, eight 0.45-inch Maxim machine guns, and four submerged Whitehead torpedo tubes. The engines are to develop about 20,000 I. H. P., giving a speed of 19 knots."

CHALLENGER, ENCOUNTER.—These cruisers are not to be sheathed as was first reported.

DUNCAN: LAUNCH.—This first-class battleship of 14,000 tons, a sister to the Russell, described and illustrated in *No. 97*, page 167, was launched at the Thames Ironworks, Blackwall, March 21.

EURYALUS: LAUNCH.—This first-class armored cruiser of 12,000 tons, a sister ship to the Bacchante which was fully described in *No. 97*, page 168, was launched at the yard of Sir John Brown & Company, Clydebank, May 20. She is the last of the Cressy class to take the water.

DRAKE.—A full description of this class was promised in the present number of the PROCEEDINGS, but it was again deferred in order to obtain, if possible, correct and clear illustrations of vessels of the class.

FANTÔME: LAUNCH, DESCRIPTION.—This gunboat, a sister to the Espiègle, was launched at Sheerness dockyard, March 28. The hull is of steel, sheathed with wood and coppered. She has one smokepipe and is barquentine rigged. Complement, 160 officers and men. The principal details are:

Armament.—Six 4-inch guns; four 3-pounders; two .45-inch Maxim machine guns.

Motive power.—Single-screw, triple-expansion engine, designed to develop 1400 I. H. P. and give a speed of 13 to 13.25 knots. Four Belleville boilers. Coal supply, 160 tons.

Dimensions.—Length, 185 feet; beam, 33 feet; draft, 11.25 feet; displacement, 1070 tons.

IMPLACABLE: TRIALS, DESCRIPTION.—This new battleship, after completing a thirty-hour trial at one-fifth power, made three unsuccessful trials at four-fifths power before a successful one was had, each one having been interrupted by hot journals. After additional oiling gear was fitted the trials passed off satisfactorily. The results were:

Date of trial	Jan. 24-25.	Mar. 12-13.	Mar. 22-23.
Character of trial	⅕ power.	⅘ power.	Full power.
Duration, hours	30.	30.	8.
Steam at boilers, pounds	220.	260.	270.
Steam at engines, pounds	. .	233.	243.
Revolutions	66.	100.	108.5
I. H. P.	3,265.	11,857.	15,244.
Speed, knots	11.10	16.75	18.22
Coal per I. H. P	. .	1.65	1.88

The Formidable, a sister ship, has not yet completed her trials owing, it is said, to leaks in her Belleville boilers.—*Journal of American Society of Naval Engineers* and other sources.

The Implacable is of the same general type as all recent British battleships and carries the same battery. To improve the manœuvring qualities the after deadwood is cut away considerably. There are two masts each carrying a military top placed very low down and an ordinary top, or searchlight platform, on the lower cross trees. The topmasts are unusually high and there are two rather large yards on each mast. The Implacable, Irresistible, and Formidable are exactly alike and differ from the London, Venerable, and Bulwark very slightly in the positions of the four 6-inch guns on the main deck, and of some of the smaller pieces, and very greatly as regards the disposition of the armor and its character. The complement is 750; or, when a flagship, 789.

Armament.—Four of the new 40-caliber, 50-ton, wirewound 12-inch guns, in turrets forward and aft. Twelve new Vickers 6-inch guns in casemates, eight on the gun deck and four on the main deck (four of these can be fired directly ahead and four directly astern). Sixteen 12-pounders: eight on the gun deck and eight on the main deck in broadside between the upper 6-inch guns. Six 3-pounders: three in each military top. These are Hotchkiss guns, mounted on circular railways, for protection against torpedo boats. There are also eight Maxim guns on the boat deck and superstructure. The two 12-pounder, 8-hundredweight guns for boat and field service have an alternative mounting gear arranged so that they may be fired over the forward breastwork. Four 18-inch submerged torpedo tubes are fitted, two forward, two aft.

Protection.—An armor belt, 15 feet wide, 9 inches thick, and 216 feet long, extends along the side amidships with its lower edge about 5 feet below water at mean load. At the ends, the belt meets diagonal bulkheads, 9 to 12 inches thick, which are tangent to, and thus enclose the bases of the barbette towers. Beyond the belt forward the side is covered with 2-inch plating, of the same width as the belt, extending to the stem where it dips down to the keel for a length of fifteen or twenty feet. This 2-inch armor is of nickel steel laid over the skin plating which is about 0.75 inch. There are two protective decks, one being of the now

usual turtleback shape, on which the armor rests all along the edges, and formed of 2-inch steel plating on the flat portion forward, while on the crown of the turtleback, the slopes and all the after flat part of the deck toward the stern, its thickness is increased to 3 inches. The second armored deck is actually the gun deck, and has a protection of 1 inch of steel all over. There is thus practically an armored cofferdam extending throughout the whole of the citadel space. The barbette towers are 12 inches thick in front and 10 inches in rear, above the belt, and 6 inches inside the belt. The hoods, or gun-houses, of the heavy guns have 10-inch slopes in front, 8-inch sides and 3-inch roofs. The forward conning-tower is 14 inches thick and has an 8-inch communication tube; the after conning-tower and tube are each 3 inches thick. In the London class the forward transverse bulkhead is done away with and the belt is to be carried forward around the stem. Instead of a short belt, 9 inches thick, with 2-inch plates up to the stem, the side armor in these ships will be 9 inches thick amidships, and taper gradually to 3 inches at the bows, the gradations being 9, 7, 5, and 3 inches. As the armor is placed over the ship's plates the belt will nowhere be much less than 4 inches thick. Internally the arrangements as to protective decks are the same. The Implacable and her two sisters have been fitted with Harvey armor; while the later vessels of the London type will have Krupp armor.

Motive power.—Twin-screw, 3-cylinder, triple-expansion engines, designed to develop 15,000 I. H. P. and give a speed of 18 knots. Twenty Belleville boilers with economizers having 37,000 square feet of heating surface. Coal supply, 900 tons at load draft; total capacity, 2200 tons.

Dimensions.—Length between perpendiculars, 400 feet; over all, 430 feet; beam, 75 feet; mean draft, 26.9 feet; displacement at this draft, 15,000 tons.

ALBION: TRIALS.—Owing to defects in her boilers this battleship has been under trial since last autumn. On her 30-hour trial at four-fifths power the results were: steam at boilers, 241 pounds; vacuum in condensers, 27 inches; revolutions, 66.1; I. H. P., 2772; speed, 11.2 knots; coal per I. H. P. per hour, 2.17 pounds; draft on trial, 26.5 feet forward and aft. On March 26, she completed her 30-hour trial at four-fifths power attaining a speed of 16.8 knots and 10,809 I. H. P. with 101.8 revolutions. The 8-hour full power trial took place March 28. With steam at boilers 257 pounds, and 13,885 I. H. P., the speed was 17.8 knots. The designed speed was 18.25 knots.

PANDORA: TRIALS.—The third-class cruiser Pandora of 2200 tons has completed her trials. On her 30-hour trial the results were: I. H. P., 3638; revolutions, 1952; speed, 16.7 knots. The 8-hour, full speed trial gave: I. H. P., 5187; revolutions, 218; speed 18.625 knots. She is the last of her class to be completed and was commenced in 1898.

TORPEDO-BOAT DESTROYERS: SEA-KEEPING QUALITIES.—The recent experiments in the British navy of sending destroyers out and keeping them at sea for weeks at a time has not added to our admiration of their sea-keeping qualities. Of the instruction flotilla which returned to Devonport about Easter time after several weeks absence—not altogether at sea by any means, but chiefly so—only four of the eight returned on time. Two had been *hors du combat* for some days and were in port repairing while the Wolf, somewhat strained herself, was delayed by having to escort the Seal, which was badly injured and narrowly escaped foundering. Several of the vessels had their decks cracked open in the heavy seas and many of the destroyers are now laid up by serious injury

to the hulls from strains received in heavy seas. The worst cases of straining and injury are in those destroyers which, like the Seal, have their engines in the center of the boat and their boilers and coal forward and abaft. The following is from a British paper:

The attempt at running the instructional destroyers away from the port for three weeks at a time, and returning to lie up for one week, has not been very successful. Never during any of the three cruises have the eight boats cruised in company, and at the conclusion of each trip one or more boats have had to pay off. At the present rate of consumption, the reserve supply of boats will not be sufficient to keep the flotilla as a squadron in being at this port. The same difficulty is being experienced at the other ports in keeping the flotillas' numbers up to an establishment of eight.

For vessels of this type to be knocking about the Channel and Irish Sea in weather which causes most other vessels to look for shelter, seems to be the height of absurdity. Nothing is gained by it, no evolution can be carried out, and nothing can be done except steam at a very slow speed and hold on as well as possible. That the boats are perfectly safe and seaworthy everyone who has been in one in bad weather admits; that is, if—and here comes the point—if they do not strain themselves. But that is just what happens.

The most serious case is that of the Seal, which has broken her back, and it is feared she will not again be fit for service—a most unfortunate ending for a comparatively new vessel, which has cost the country about £75,000. She was simply struck by an enormous wave last Tuesday afternoon, when in the Bristol Channel, on her way from Birkenhead to Devonport. The shock was terrific, and those below deck at first thought that she had crashed at full speed into a large vessel or other obstruction. Those on deck, however, feared what had happened, and their fears were realized when they discovered that the upper deck was cracked across over the foremost bunker sufficient to let daylight into the stokehold, and the side plates were split down to a depth of eighteen inches. Assistance was at once signalled for, and in response the second division of the flotilla was instructed to escort the Seal into St. Ives. Here a temporary repair was effected, and, waiting for a break in the continuous bad weather, the Seal, under convoy of the Wolf, made her way to Plymouth.—*Journal of American Society of Naval Engineers* and British papers.

KANGAROO AND MYRMIDON: TRIALS.—These torpedo-boat destroyers have completed their trials with the following results:

	Kangaroo.	Myrmidon.
Speed for 3 hours	30.03	30.229
Revolutions per minute	378.8	379.2
I. H. P.	6463	6303
Air-pressure	2.7	2.8

The weather was heavy during the trial of the Kangaroo. These vessels are sister ships to the Syren described in the PROCEEDINGS for March, page 170.

LIVELY: TRIALS.—The torpedo-boat destroyer Lively, built by Laird, of Birkenhead, has completed her trials. The mean results of six runs over the measured mile were: steam, 229.5 pounds; I. H. P., 6354; speed, 30.19 knots. The mean speed for the three hours was 30.278 knots.

SUBMARINE BOATS.—The British government has decided to build five boats of the Holland type, the general features of which are practically identical with those now under construction for our government. The following description of the British boats is chiefly from "Engineering."

The dimensions are: Length, 63 feet 4 inches over all; 11 feet 9 inches beam, and 120 tons displacement when submerged. The boats will be provided with means of expelling torpedoes either with the boat stationary, during a run on the surface, or steaming at any speed submerged. The armament consists of one torpedo-expulsion tube at the extreme forward end of the vessel, the muzzle covering opening outward two feet below the light water-line. Interlocking safety devices are employed to prevent accident while operating valves for the expulsion of the torpedo.

The general construction of the vessels is such that all portions of the exterior of the hull are free from projections of a nature to be entangled by ropes or other obstacles when submerged, and the lines of the hull are specially designed to minimize resistance for surface cruising. The plating and frames are to be of steel of sufficient size and thickness to withstand the pressures of depths not over 100 feet. The seams are designed to give high efficiency to the joints. The bulkheads are located not only to ensure safety in the event of collision, but to stiffen the hull as a whole. Decks are to be provided throughout the entire length of the interior of the vessel, combined with beams and floors to carry the weight of the machinery. The tanks are to be of steel, braced and stiffened according to the requirements, and riveted and caulked absolutely tight. Manholes will be located to allow access to the interiors of all the tanks.

The superstructure is to be located to allow of an above-water deck when the vessel is light for surface running, also to have means of stowing anchor and lines and to afford mooring facilities to the vessel. A deck, 31 feet long, will be provided for use on such occasions.

The rudders are of steel plates, supported by skegs at the stern. As shall presently be explained, the vessel dives like a porpoise instead of sinking on an even keel, and for this purpose there are horizontal as well as vertical rudders.

The conning-tower is of steel armor, the outside diameter being 32 inches and the minimum thickness 4 inches, with ports for observation by the navigator.

The propulsion of the vessel on the surface is effected by an Otto engine of the gasoline type.

An electric motor of the water-proof type is provided for giving the vessel a speed of 7 knots when submerged, and is worked by storage batteries having a capacity which will admit of a four hours' submerged run at 7 knots. Gearing is provided to allow for the charging of the battery, for driving the propeller from the main engine, or moving the engine from the main motor, the combinations being effected through clutches, which are operated as desired. Switches, etc., are provided for the safe and efficient distribution of the electric current throughout the vessel. The lighting of the boat is effected by portable incandescent electric lamps, while there are several ports and openings in the hull to admit daylight.

The ballasting system consists of apparatus for quickly changing the vessel from light to a diving condition, and for keeping her displacement constant in different waters—*i. e.* in salt or fresh water. The same ar-

rangement is utilized for enabling the navigator to adjust the longitudinal trim when diving, or for compensating for the variable weights installed or expended from time to time, such as discharging torpedoes, etc. The air supply and ventilation are secured by compressed air stored on board the vessel, the gasoline vapors from the engine being carefully excluded by ingenious arrangements. Safety valves are arranged to relieve any excess of pressure in the vessel over that of the atmosphere.

Steering and diving engines are provided, and are fitted with automatic means of moving the rudders to the desired positions to prevent the vessel from inclining to excessive angles during diving or rising, and to keep the depth of submergence constant, as well also as to bring the vessel to a horizontal position at the required depth, and to prevent diving to excessive depths. In addition to these mechanical means, steering and diving can be executed by hand gear if desired. The compasses carried on board the vessel are compensated and adjusted so that the boat can be steered with equal accuracy when submerged as on the surface.

The general operation of the boat may thus be briefly described: Before it is desired to make a dive, the boat is brought to an "awash" condition, with only the conning-tower ports above the water. The dive is then made at a small angle until the proper depth is reached, when, by automatic means, the boat is brought to a horizontal position. After the discharge of the torpedo from the fixed bow tube the compensation for the weight of the torpedo is made automatically, causing only a slight change of trim for a few seconds. Provision is made for quick rising and diving, the time of appearance of the conning-tower above water being dependent upon the skill of the navigator.

The official trial will be a surface run of ten miles at a speed of 7 knots, and a submerged run of two miles at a speed of 7 knots. At the end of this last run a service torpedo will be fired at a target 150 feet long by 16 feet deep, the upper edge being awash and at right angles to the course. During the submerged run the boats must not come to the surface more than three times from the time of starting until the discharge of the torpedo, and the duration of each appearance must not exceed one minute. Suitable masts are provided for observing the movements of the boat while submerged.

GREECE.

NEW PROGRAM.—It is reported that the navy department is going to order abroad the construction of two cruisers, two torpedo-boat destroyers and six torpedo boats. A reorganization of the navy is also under consideration.

ITALY.

BUDGET FOR 1902.—The budget for 1902 has not yet been approved by the Italian parliament. As the views in regard to it are very diverse the outcome cannot be foreseen. It is therefore useless to enumerate the various proposals, many of which are likely to be rejected.

AMMIRAGLIO DI ST. BON, EMANUELE FILIBERTO: TRIALS, DESCRIPTION.—The official trials of the Emanuele Filiberto gave the following results:

	Natural draft.	Forced draft.
Duration of trial, hours	6	1.5
Mean draft, feet	24.51	24.64
Displacement, tons	9660	9740
Steam pressure in boilers	150	145
Steam pressure at engines	146	143
Air pressure in ash pits, inches	....	1 to 1.2
Revolutions per minute	94	97.7
I. H. P., mean	9526	13,442
Speed, knots	16.8	15.71
Slip, per cent	9.35	18.42
Days elapsed since last docking	80	177

The low speed on the forced draft trial is ascribed to the foul condition of the ship's bottom, due to lying in port nearly six months after the bottom was cleaned.

The results of the natural draft trial of the St. Bon were: steam pressure at boilers, 134 pounds; I. H. P., 9734; revolutions, 93.5; speed, 17.5 knots. Recent forced draft trials, which are stated to be only preliminary, gave a speed of 19.2 knots with 104 revolutions.

These battleships have been under construction for six years and were launched as long ago as 1897. They were the first of a new type which has received many variations, for it may in some measure be regarded as the progenitor of the Colon and Garibaldi, though at first glance the differences are very considerable. These battleships do not at all resemble the plans generally published in the various annuals, being long and low. The freeboard at the bow is possibly 15 feet—amidships and aft probably not much over 10 feet. The hull is of steel without sheathing. There are two smokepipes, spaced wide apart in opposite ends of the superstructure with a military mast carrying two tops and a very high topmast between them. The complement is 600 officers and men; and the principal details are:

Armament.—Four 10-inch guns in turrets over barbette towers which rise eight or nine feet above the main deck and give a very unusual appearance to the ship. Eight 6-inch guns: one each side in the ends of the armored redoubt which rises amidships above the main deck in the form of a superstructure; outboard of these guns the superstructure is cut away so that the other pairs of 6-inch guns can fire directly ahead or astern according to their position. Two 2.9-inch guns. Eight 6-pounders. Nineteen 1-pounders. Four submerged torpedo tubes.

Protection.—Complete nickel-steel belt, 9.8 inches thick amidships and 3.9 inches at the ends. Barbette towers, 9.8 inches. Turrets, 5.9 inches. Armored superstructure enclosing 6-inch battery, 5.9 inches. Conning-tower, 5.9 inches. Protective deck, 3.1 to 1.5 inches.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 13,500 I. H. P. and give a speed of 18 knots. Twelve 3-furnace cylindrical boilers. Coal supply, 600 tons; total capacity, 1000 tons; also liquid fuel in double bottoms.

Dimensions.—Length, 344.5 feet; beam, 69.3 feet; mean draft, 24.75 feet; displacement, as designed, 9800 tons. Owing to changes introduced in building, the displacement at normal draft with 600 tons of coal is considerably increased.

AGORDAT: TRIAL.—This torpedo cruiser has recently completed her trials with the following results:

Date of Trial	Feb. 11	Mar. 6
Draft, mean, feet	9.77	10
Displacement, tons	1200	1246
Days since last docking	120	150
Duration of trial, hours	3	6
Steam at boilers	203	169
Steam at engines	169	155
Air pressure, inches	0.47	2.2 to 3.0
Revolutions	232	190
Mean I. H. P.	8550	4670
Mean speed, knots	22.2	18.8
Slip of screw, per cent	12.6	9.5
Coal per I. H. P.	——	2.04

During the full power trial the speed at times exceeded 23 knots.

The Agordat and her sister ship the Coatit have been under construction since 1896. The hull is of steel without sheathing. The complement is 150 officers and men. The principal details are:

Armament.—Twelve 12-pounders. Eight 6-pounders. Two 1-pounders. Two torpedo tubes.

Protection.—Protective deck, 0.75-inch thick. Cofferdams.

Motive power.—Twin-screw, triple-expansion engines, designed to develop 7500 I. H. P. and give a speed of 23 knots. Eight Blechynden water-tube boilers.

Dimensions.—Length, between perpendiculars, 287.4 feet; beam, 30.6 feet; mean draft, 10.33 feet; displacement, 1313 tons.

OSTRO: LAUNCH, DESCRIPTION.—The torpedo-boat destroyer Ostro was launched at the yard of F. Schichau, Elbing, Prussia, February 9, 1901. She is one of six ordered of Herr Schichau, two of which are completed, the Lampo and Freccia; and three others, the Dardo, Euro, and Strale, were ready for trial some time since. The principal details are:

Armament.—One 12-pounder; five 6-pounders; two torpedo tubes.

Motive power.—Twin-screw, triple-expansion engines, designed to develop 6000 I. H. P. and give a speed of 30 knots. Coal capacity, 60 tons.

Dimensions.—Length between perpendiculars, 198.6 feet; beam, 21.32 feet; draft, forward 5.74 feet; draft, aft, 8.36 feet; displacement, 320 tons.

DELFINO: DESCRIPTION AND EXPERIMENTS.—It is reported that the Italian submarine boat Delfino is to be prepared for further experiments in submarine navigation. This boat was designed by the late Signor Pullino, Italian naval constructor, and was completed in 1896. The hull is fusiform, or cigar-shaped, and built of steel 30 (?) millimeters (1.2 inches) thick. The length is 78.7 feet; beam and depth, 9.5 feet; displacement when totally submerged, about 107 tons. Power is obtained from an accumulator battery of 300 elements supplying an electric motor driving a single screw. Two smaller screws are used to facilitate diving and rising. Steadiness and preservation of immersion at a constant depth are obtained by two side rudders or "ailettes," while the steering is effected by rudders at each end of the boat. The armament consists of two torpedo tubes in the bow. The air supply is based upon that necessary for twelve men during 7 or 8 hours, which is the time endurance of the accumulators at the ordinary speed. Many changes have been made in the Delfino since her first trials, but of late not much has been done with her. Her cost was about $60,000.

JAPAN.

BUDGET FOR 1901-1902.—The naval budget for the fiscal year April 1, 1901, to March 31, 1902, includes:

1. Ordinary expenses	42,522,517	marks (1 mark = $0.238).
2. Extraordinary expenses	37,971,377	"
3. First instalment for commencing steel and armor plate works for the navy at Kuré	2,272,521	"
Total	82,766,415	"

The same items for the preceding year amounted to 85,938,400 marks. The total cost of the armor plate and steel works is placed at 13,314,000 marks and the time to complete is estimated at five years.

The total cost of the naval establishment foots up to 105,231,000 marks. Among the items of the budget the following are interesting:

For new construction, ships building and projected	19,809,300	marks.
For torpedo boats and destroyers	9,030,000	"
For armament	8,941,800	"
For improvement of naval ports	3,387,000	"

The following ships now under construction will be completed during the year: Battleship Mikasa, 15,360 tons; armored cruiser Iwate, 9900 tons; torpedo cruiser Chihaya, 1250 tons. The construction of the following vessels will be continued or commenced during the year:

Two protected cruisers at Yokosuka dockyard, the Niikata and Tsushima. Their dimensions are: Length, 334.6 feet; beam, 43.96 feet; draft, 16 feet; displacement, 3420 tons. The I. H. P. of the machinery will be 9400 and the speed 20 knots.

The following torpedo craft are building:

Name.	Displacement (tons).	Where building.
Destroyers.		
Shirakuma	381	Thorneycroft, Chiswick.
Asashio	381	" "
Kasumi	381	Yarrow, Poplar.
Akatsuki	381	" "
Harusame	381	Yokosuka dockyard, Japan.
Murasame	381	" " "
Hayatori	381	" " "
Asagiri	381	" " "
Torpedo boats.		
Kari	152	Kuré dockyard, Japan.
Aotaka	152	" "
Hato	152	" "
Tsubame	152	" "
Hibari	152	" "
Kiji	152	" "

—*Marine Rundschau.*

NETHERLANDS.

OPHIR, PANGRANGO, RINDJANI: LAUNCH, TRIALS, DESCRIPTION.—These three boats are alike in all essential respects and were built, or are building, at the yard of Messrs. Yarrow & Company, Poplar, where the

Ophir was launched March 6, the Pangrango April 17, and where the Rindjani is still on the ways. The two first-named boats are complete and have had their trials with the following results:

The trial of the Ophir, with a load of 30 tons, which is her normal condition as designed, attained a mean speed of 25.3 knots for three hours with forced draft, air pressure 1.5 inches.

The Pangrango, tried April 30, did a little better, averaging 25.99 knots under the same conditions of load for three hours with the same air pressure.

After the completion of the acceptance trials experiments were made to test Holden's system of burning oil to supplement coal. A first trial was made with coal only and a speed of 24.5 knots obtained over a long distance run. Then the oil-burners were started, the coal burning being continued without change of amount supplied to the furnaces. With the oil and coal together the speed was immediately increased to 26.5 knots. The coal burned throughout the trial was at the rate of 2800 pounds per hour and after the oil was introduced the consumption of this was 700 pounds per hour (Borneo oil). In the Ophir there are two boilers of equal size, and a further trial was made at a slower speed with oil only, using one boiler, when a speed of 14 knots was readily obtained, burning 500 pounds of oil per hour.

NORWAY.

SUBMARINE BOATS.—The Norwegian navy department has decided to build submarine boats for coast defence. Admiral Borresen, chief of the general staff of the navy, has submitted to the Storthing a request for a supplementary credit of $170,000 for the construction of a boat of the Holland type, which is to have a speed of 9 knots, when running on the surface, and 7 knots when submerged. This is the first of a flotilla of six of this class which it is desired to complete in two years. Admiral Borresen believes that a fleet of twenty of such boats would suffice to protect Christiania and the southwest coast of Norway against all hostile attempts.

UNITED STATES.

CONDITION OF VESSELS UNDER CONSTRUCTION.

No.	Name.	Where building.	Per cent. completed. June 1.	May 1.
	Battleships.			
7.	Illinois	Newport News.	94	92
10.	Maine	Cramp, Phila.	52	50
11.	Missouri	Newport News.	37	32
12.	Ohio	Union Iron Works, S. F.	53	42
13.	Virginia	Newport News.	0	0
14.	Nebraska	Moran Bros., Seattle.	0	0
15.	Georgia	Bath Iron Works, Me.	0	0
16.	New Jersey	Fore River Co., Mass.	0	0
17.	Rhode Island	" "	0	0
	Armored Cruisers.			
4.	Pennsylvania	Cramp, Phila.	0	0
5.	West Virginia	Newport News.	0	0
6.	California	Union Iron Works, S. F.	0	0
7.	Colorado	Cramp, Phila.	0	0
8.	Maryland	Newport News.	0	0
9.	South Dakota	Union Iron Works.	0	0

CONDITION OF VESSELS UNDER CONSTRUCTION—*Continued.*

No.	Name.	Where building.	Per cent. completed June 1.	Per cent. completed May 1.
	Protected Cruisers.			
14.	Denver	Neafie & Levy, Phila.	47	45
15.	Des Moines	Fore River Co., Mass.	34	28
16.	Chattanooga	Nixon, Elizabethport, N. J.	32	29
17.	Galveston	Trigg Co., Richmond.	27	22
18.	Tacoma	Union Iron Works, S. F.	20	18
19.	Cleveland	Bath Iron Works, Me.	55	55
20.	St. Louis	Neafie & Levy, Phila.	0	0
21.	Milwaukee	Union Iron Works.	0	0
22.	Charleston	Newport News.	0	0
	Monitors.			
7.	Arkansas	Newport News.	57	54
8.	Nevada	Bath Iron Works.	67	66
9.	Florida	Nixon, Elizabethport, N. J.	66	65
10.	Wyoming	Union Iron Works.	75	73
	Torpedo-Boat Destroyers.			
1.	Bainbridge	Neafie & Levy.	94	94
2.	Barry	" "	88	88
3.	Chauncey	" "	90	90
4.	Dale	Trigg Co., Richmond.	94	93
5.	Decatur	" "	96	95
6.	Hopkins	Harlan & Hollingsworth, Del.	75	75
7.	Hull	" "	74	74
8.	Lawrence	Fore River Co., Mass.	99	99
9.	McDonough	" "	98	98
10.	Paul Jones	Union Iron Works.	85	87
11.	Perry	" "	93	93
12.	Preble	" "	92	90
13.	Stewart	Gas Engine & Power Co., N. Y.	53	53
14.	Truxtun	Maryland Steel Co., Balto.	68	67
15.	Whipple	" "	67	67
16.	Worden	" "	67	67
	Torpedo Boats:			
19.	Stringham	Harlan & Hollingsworth, Del.	98	98
20.	Goldsborough	Wolff & Zwicker.	99	98
21.	Bailey	Gas E. & P. Co., N. Y.	100	99
24.	Bagley	Bath Iron Works.	99	99
25.	Barney	" "	99	99
26.	Biddle	" "	99	98
27.	Blakely	Geo. Lawley & Son, Mass.	98	98
28.	De Long	" "	98	98
29.	Nicholson	Nixon, Elizabethport.	89	88
30.	O'Brien	" "	92	90
31.	Shubrick	Trigg Co., Richmond.	100	99
33.	Thornton	" "	97	97
34.	Tingey	Columbian Iron Works, Balto.	68	68
35.	Wilkes	Gas E. & P. Co.	80	79
	Submarine Boats:			
1.	Plunger	Nixon, Elizabethport.	10	9
3.	Adder	" "	60	50
4.	Grampus	Union Iron Works.	51	50
5.	Moccasin	Nixon, Elizabethport.	58	40
6.	Pike	Union Iron Works.	50	50
7.	Porpoise	Nixon, Elizabethport.	55	36
8.	Shark	" "	53	35

ENLISTMENT OF FILIPINOS.—The Secretary of the Navy has authorized Admiral Remey to enlist as firemen, coal passers, etc., 500 Filipinos. Many have hitherto been employed on the small gunboats but were not enlisted, being engaged merely for short trips.

MILWAUKEE: CONTRACT AWARDED.—In April the contract for the building of the protected cruiser Milwaukee, 9800 tons, was awarded to the Union Iron Works of San Francisco. The contract price is $2,825,000; time to complete, thirty-six months. The ship will be built on the Department's designs.

COLORADO: KEEL LAID.—The keel of this armored cruiser was laid at the yard of the Cramp Shipbuilding & Engine Company, Philadelphia, April 26. The keel of the Pennsylvania, a sister ship, will not be laid until after the launch of the battleship Maine, which will probably take place about the time these notes go to press.

OHIO, MAINE: LAUNCH, DESCRIPTION.—These two battleships are alike in all essential respects. The Ohio is building at the Union Iron Works, San Francisco, Cal., where she was launched May 18; and the Maine is building at the yard of the Wm. Cramp Shipbuilding and Engine Company, Philadelphia, and will probably be launched before this number of the PROCEEDINGS is ready for issue. These vessels are developments of the Alabama type which they resemble in very many respects. The dimensions and coal supply are considerably increased; they have another pair of 6-inch guns; the armor is very similarly applied but is Krupp instead of Harvey; and the machinery and boilers are very much changed, water-tube boilers being fitted, and the speed increased two knots. The hull is of steel without sheathing. The freeboard is about the same as that of the Alabama and Iowa, and the masting is similar to the Alabama's. There are three smokepipes and they are on the fore and aft midship line. There are fourteen boats, including one 40-foot and one 36-foot steamer, and they are handled by four steam cranes. Hydraulic steering gear is used on the Ohio. She has four dynamo rooms and eight 32-kilowatt generating sets. There are four searchlights, two on the pilot house and two on the main mast. The keel of the Ohio was laid February 15, 1899, and her contract price was $2,885,000. The complement is 40 officers and 511 men. The principal details are:

Armament.—Four 40-caliber, 12-inch guns (M-99, muzzle velocity, 2800 f. s.) in pairs in electrically trained balanced turrets forward and aft. Sixteen 50-caliber 6-inch guns (M-99, muzzle velocity, 2900 f. s.) in casemates: five each side in a central battery on the gun deck; one each side in single casemates on the gun deck forward with fire directly ahead; two each side in double casemates on the upper deck, forward pair firing directly ahead and after pair directly astern. Six 50-caliber 3-inch guns (M-99, muzzle velocity, 3000 f. s.). Two 3-inch field guns. Eight 6-pounders. Six 1-pounders. Two Colt machine guns. Two submerged torpedo tubes. The ordinary supply of ammunition is 240 rounds of 12-inch, 3200 rounds of 6-inch, about 2400 rounds of 3-inch, 4800 rounds of 6-pounder, and 4000 rounds of 1-pounder ammunition. Additional amounts will be carried in time of war.

Protection.—Complete belt, 3.5 feet above water and 4 feet below, having a thickness of 11 inches for a depth of 4.25 feet from the upper edge and tapering to 7.5 inches at the bottom. The upper works between the main turrets are protected by side armor 6 inches thick laid over the side plating. This is closed at the ends by 9-inch diagonal bulkheads.

Forward, this bulkhead rises from the armor deck to the upper deck; aft, the ends of the belt armor are joined to the barbette towers by diagonal bulkheads of 9 inches, but the central superstructure does not extend so far aft and it is closed by a 6-inch diagonal bulkhead, the ends of each diagonal meeting just forward of the after barbette tower. The protective deck is flat amidships between the barbette towers, but forward and aft it slopes down to meet the lower edge of the belt at the sides. The thickness on the flat is 2.75 inches; on the slopes forward, 4 inches; and on the slopes aft, 3 inches. Cofferdams are built on the protective deck from the diagonal bulkheads to the bow and stem; and on the berth deck for nearly the whole length of the vessel. All cofferdams are to be filled with corn-pith cellulose. The turrets of the 12-inch guns have inclined fronts 12 inches thick and 11-inch sides. The barbette towers are 12 inches thick on the exposed sides and 8 inches in rear. There are two conning-towers, the forward one 10 inches thick with 7-inch communication tube 12 inches in inside diameter; and the after one 6 inches thick with 3-inch (?) tube.

Motive power.—The engines are twin-screw, vertical, 3-cylinder, triple-expansion, with cylinders of 38.5, 59, and 92 inches diameter and 42 inches stroke. At 126 revolutions they are expected to develop 16,000 I. H. P. and give a speed of 18 knots. The Maine will be fitted with Niclausse boilers but the Ohio with those of the Thorneycroft type. The coal supply at load draft is 1000 tons; total capacity, 2000 tons.

Dimensions.—Length on load water-line, 388 feet; beam, 72.2 feet; mean draft at normal load, 23.5 feet; normal load displacement of the Ohio, 12,440 tons; of the Maine, 12,300 tons; full load displacement of both, about 13,500 tons; tons of displacement per inch of immersion at normal draft, 52.

BAGLEY, BARNEY: TRIALS, DESCRIPTION.—These two torpedo boats have completed their trials. On May 15 the Barney made 29.1 knots for two hours instead of 28 knots as required by contract. The Bagley, a sister boat, the next day averaged 29.2 knots. The boats were both built at the Bath Iron Works from the contractors' own designs. Complement, 3 officers and 26 men. Contract price, $161,000. The principal details are:

Armament.—Three 17.7-inch torpedo tubes; three 3-pounders.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 4200 I. H. P. and give a speed of 28 knots. Normand water-tube boilers.

Dimensions.—Length on water-line, 157 feet; beam, 17 feet; mean draft, 4.6 feet; maximum draft aft with full load, 8 feet; displacement, 167 tons.

BAILEY: TRIALS, DESCRIPTION.—The torpedo boat Bailey had her official trial April 25 in Long Island Sound. The mean speed for the two hours was 30.2 knots and the maximum speed attained was 31.12 knots with 418 revolutions. The Bailey was built by the Gas Engine and Power Company and Charles Seabury, Morris Heights, New York, where she was launched December 15, 1899. The complement is 3 officers and 53 men. The contract price was $210,000. The principal details are:

Armament.—Two 17.7-inch torpedo tubes; four 6-pounders.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 5600 I. H. P. and give a speed of 30 knots. Seabury water-tube boilers. Normal coal supply, 20 tons; bunker capacity not reported but probably about 100 tons.

Dimensions.—Length on load water-line, 205 feet; beam, 19.2 feet; mean draft, 6 feet; maximum draft aft at full load, 7.9 feet; displacement, 235 tons; tons displacement per inch of immersion, 6.88.

PERRY: UNSATISFACTORY TRIAL, REMARKS.—The preliminary and the standardizing trials of this torpedo-boat destroyer, building by the Union Iron Works from the design of the Navy Department (described in PROCEEDINGS *No. 97*, page 190), were carried out in San Francisco Bay between the 25th of February and the 5th of April, and, in consequence of the results being so far below what was anticipated it has been determined to suspend further trials pending the construction of screws with more surface than those with which she was fitted during these trials. Should she succeed in reaching the contract speed with the new screws, the Preble, also building by the Union Iron Works, will be tried with similar ones; but should she fail, a change will be made in the shape of the stern.

As completed, she draws 14 inches more water at the stern than was contemplated in the design, and is of about 470 tons displacement instead of 430. This increase being principally in weights of the hull. Some of the trial weights were removed to improve her trim before commencing the standardizing trials. The results of these trials, made on different days, are:

Speed.	Revolutions.	I. H. P.
17.	177.8	947
19.72	212.6	1792
23.31	269.1	4005
24.17	287.2	4866
25.50	308.1	6040
27.68	333.2	7470
28.20	338.5	7752

The contract speed is 29 knots.

As a consequence of these trials, and of runs in the model tank of the model of the vessel as completed, it is probable that the sterns of the destroyers Bainbridge, Barry, and Chauncey, building by Messrs. Neafie & Levy, and of the Paul Jones, building by the Union Iron Works and yet unlaunched, will be flattened in order to reduce the resistance which the peculiar shape of the stern appears to offer.

Two other destroyers, the Dale and Decatur, building by the William R. Trigg Company, have been launched, but as the speed in their case is to be but 28 knots, it is probable that the alteration of the stern will not be made until after they have been tried.—*Journal of American Society of Naval Engineers.*

SHUBRICK, THORNTON: TRIALS, DESCRIPTION.—The Shubrick completed her official trials April 5, having made an average of 26.07 knots for two hours. Subsequent corrections and allowances for tide, etc., increase this to 26.75 knots. The trial of the Thornton on April 12 was stopped on account of the bursting of a boiler tube. These boats are alike in all respects and were built at the yard of the William R. Trigg Company, Richmond, Va., where they were launched; the Shubrick on October 31, 1899, and the Thornton on May 15, 1900. The complement is 3 officers and 26 men. The contract price was $129,750. The principal details are:

Armament.—Three tubes for 17.7-inch whitehead torpedoes; three 3-pounders.

Motive power.—Twin-screw, vertical, triple-expansion engines, designed to develop 3000 I. H. P. and give a speed of 26 knots. Thorneycroft water-tube boilers. Coal supply, 10 tons; total capacity, 70 tons.

Dimensions.—Length on water-line, 175 feet; beam, 17.5 feet; mean draft, 4.7 feet; maximum draft aft with full load, 7.5 feet; displacement, 165 tons; tons displacement per inch of immersion at load draft, 5.4.

TINGEY: LAUNCH, DESCRIPTION.—The torpedo boat Tingey was launched at the Columbian Iron Works, Baltimore, March 25. She is one of the group of twelve torpedo boats and sixteen destroyers appropriated for by Congress in 1898. She is in all respects, including boilers, a sister ship to the Shubrick and Thornton described above. The contract price was $168,000. Owing to the financial condition of the Columbian Iron Works, the Navy Department declared the contract forfeited, and was about to advertise for bids for completing her; but a new company having been formed to operate the Columbian Iron Works, the Department has decided to entrust the completion of the Tingey to this company.—*Journal of American Society of Naval Engineers.*

ILLINOIS: TRIAL SPEED.—On June 15, after these notes had been prepared and when they were about to be transmitted to the printer, it was learned that the battleship Illinois, which returned from her trial trip the day before, had made a mean speed of 17.45 knots on her four hour trial, after correcting the apparent speed of 17.31 knots for tide, etc.

AMMUNITION.

CAPPED PROJECTILES.—Mr. P. M. Staunton, late Captain of the Royal Artillery, in a letter to the editor of *Engineering* (London), presents his views on the action of the cap which are somewhat at variance with the generally accepted ideas. He has also taken out patents for projectile caps designed in accordance with his theories. Inasmuch as the absolute correctness of no theories in regard to the function of the cap have received conclusive proof, it is interesting to examine all new ones which are within the bounds of reason.

After comparing the results of the trials of various forms of caps, Mr. Staunton concludes that:

"If my views be correct, the most important functions of caps on armor-piercing projectiles are to delay 'full impact' and to distribute the shock thereof more fully over the superficial area of the projectile, thereby protecting its structure from fracture and enabling more of its kinetic energy to be expended in doing work on the armor, and it follows as a matter of demonstration that for the purpose of attacking steel armor plating with a high striking velocity, such caps shall be so made as:

"1. To further increase the distance between the point of initial impact and the point of the projectile.

"2. To increase the duration of their resistance to compression on impact.

"3. To enable them to take up a larger proportion of the initial pressure of impact before being fractured or forced back on the projectile's nose.

"4. To enable them to distribute the shock incidental to such pressure over an increased superficial area of the projectile.

"5. To provide a soft cushion which will break the disintegrating force of impact on the projectile's point.

"6. To provide a ready means whereby the projectile may force its way through and free of the cap when penetration is commencing."

The form of cap which Mr. Staunton seems to prefer is one which extends beyond the point of the projectile about one-third of a caliber, and extends as a thin envelope, of decreasing thickness, more than two-thirds the way to the base. The projectile itself is therefore slightly coned from the bourrelet to the base. The axis of the cap above the point is cored out by removing a small axial cylinder of a diameter of perhaps one-eighth a caliber, and the cavity so formed is filled with lead. The cap itself is of hard and tough steel. Upon striking the armor plate, the cap is destroyed, being split apart as the projectile advances through it. It has then, however, performed what Mr. Staunton assumes to be its chief function which is to distribute the force of the blow over the mass of the projectile—instead of allowing it all to be received on the point—without sensibly diminishing the work done upon the plate. Incidentally, of course, the cap does support the point against fracture until it is fairly entered into the plate, though not to the same extent as a closer-fitting cap of soft steel.

SHRAPNEL: NEW GERMAN MODEL.—A new design of shrapnel is patented by the Rheinische Metallwaaren und Maschinfabrik (Germany). The novelty consists in longitudinal ribs extending along the inner surface of the shell. Two objects are expected to be secured by this design. First, the shell is strengthened without sensibly increasing the weight or capacity; and second, the rotary displacement of the balls is prevented. The balls themselves are provided with flats so that they may be packed firmly within the shell, one above the other, and thus prevent wedging.

SHELL AND SHRAPNEL: BRITISH SHELL AND SHRAPNEL IN SOUTH AFRICA.—According to Herr Gentz, a Prussian officer who was in the Boer service, the British artillery practice in South Africa was very good but many of the British shrapnel and shell did not burst at all and few if any of the shrapnel burst effectively, the case not breaking up as it should so that the dispersion of shell fragments and balls was very slight. From other sources it is learned that the lyddite shells for the field guns were a disappointment. The explosion was usually one of low order, showing greenish fumes instead of the blackish ones of detonation. The British technical papers say that lyddite is not a success in calibers below four inches and not fully successful in shells of less than six-inch caliber. Whether the small shells rupture before the proper temperature and pressure are reached, or whether small amounts of the explosive do not develop the requisite temperature with sufficient rapidity for detonation is not stated.

GAS-CHECKS FOR PROJECTILES.—Many persons still hold to the opinion that erosion of the bore is due to the escape of gas past the projectile. Either because of holding this view, or because probable purchases of ammunition do, Sir Hiram Maxim has brought out an improvement of his base-ring gas-check for projectiles. In the present model a movable metal ring, at the moment of firing, presses a semi-plastic ring out against the surface of the bore. As the projectile moves along the bore

the movable ring acts as a plunger and causes a quantity of fatty material, contained in a cavity in the projectile, to be continuously supplied to the semi-plastic ring.

SPECIAL POWDER CASE TO REDUCE EROSION.—Of all the means taken to cure the erosive qualities of nitroglycerin powders such as cordite, the most astonishing is that which is made the subject of a patent by Sir A. Noble. He considers that the erosion of guns is mainly due to the excessive heat developed in the combustion of the nitroglycerin powders. (This is like saying that a man who is hung dies of heart failure.) In order to decrease the temperature without diminishing the ballistic effect a water case is placed in front of the charge and it is expected that the expansion of the vaporized water will more or less compensate for the loss occasioned by the decreased temperature of the gunpowder gases.

POWDER BAGS WOVEN FROM SMOKELESS POWDER THREADS.—Krupp has taken out three or more patents, differing but little in general character, covering processes of making the envelope or bag for the powder charge of a fabric woven from strands or threads of smokeless powder. It is hoped in this way to prevent the collection of any residue in the bore.

PRIMERS: NEW U. S. NAVY COMBINATION PRIMERS.—The new combination electric and percussion primer is now being issued to the service for all guns having primer seats in the mushroom stalk fitted for their use. The new primer differs from the old ones both in size and shape. It is about the size of a 32-cal. revolver cartridge shell but three or four times as long.

FUSES.—Krupp has patented an improvement on his well-known fuse which has an adjustable time ring like our own Navy fuze (Sweet's). The improvement consists in better means for jamming and holding the ring in the position in which it is set. It would seem from this that the fuse has given trouble in this respect. A new time fuse is the combined invention of Lieutenant A. T. Dawson (late R. N.—now of Sir W. T. Armstrong, Whitworth & Company), G. T. Buckham, and S. V. Dardier. It is a combination time and percussion fuse but the description is inadequate to give a correct understanding of the mechanism. The ignition is caused by a pellet which flies to the rear to fire the time train and another pellet which flies forward and strikes a cap when the projectile is suddenly checked or stopped.

ARMOR.

TRIAL OF A 6-INCH ARMSTRONG, SPECIAL PROCESS, NICKEL-STEEL PLATE.—The trial took place February 7, 1901, at Whale Island, Portsmouth, and was incompletely reported in PROCEEDINGS *No. 97*, page 194. Plate: 8 feet by 6 feet by 6 inches; secured by eight bolts to a backing 3.8 feet thick. The gun used in all five rounds was a 6-inch, British service type. The projectiles were all Holtzer armor-piercing, apparently from an old lot made many years ago. In this connection see letter from the Holtzer Works appended to the trial data. The results of the trial were as follows:

Round.	Weight of Projectile (lbs.)	Striking Velocity. (f.s.)	Striking Energy. (f.t.)	Point of Impact.	Effect on Plate.	Effect on Projectile.
1	100.5	1997	2779	2 ft. from right edge and 2 ft. from bottom.	Point of shot imbedded, but was shaken out by round 4; penetration then found to be 2.3 inches; inner area of damage, 12 by 10 inches; face flaked off, 16 by 18 inches; no cracks. Surface shaken at under side and flaked off further at round 2. Rear of plate slightly bulged; crack formed part way around bulge.	Projectile broken up.
2	100.0	2016	2818	2 ft. from left edge and 2 ft. from bottom.	Point of shot embedded, but shaken out by round 4; penetration then found to be 2.7 inches; inner area of damage, 12 by 12 inches; face flaked off 23 by 21 inches; no cracks. This round increased the flaking at round 1, and at round 3 the flaking of this round was increased: Marked bulge in rear of plate; crack extending nearly all around it.	Projectile broken up.
3	100.5	1974	2717	2 ft. from left edge and 2 ft. from top.	Point of shot embedded. After point of shot was shaken out, the penetration was found to be 1.6 to 1.7 inches; face flaked off 15 by 12 inches; flaking around impact 2 increased; no cracks. Faint bulge on rear of plate behind point of impact, no cracks.	Projectile broken up.
4	101.0	1975	2732	2 ft. from right edge and 2 ft. from top.	Point of shot imbedded, but shaken out by round 5; penetration then found to be 1.5 inches; face flaked off, 22.5 by 20.5 inches; a crack now showed from right hand edge of round 1 to right hand edge of plate, depth not ascertained. Further flaking at round 3. Bulge in rear of plate not perceptible in the photograph and is uncracked.	Projectile broken up.
5	100.0	1986	2735	Center of plate.	Point of shot imbedded. As the point of the shot remained imbedded, the full depth of the penetration could not be measured. As the back bulge was much higher than that of any other shot, the penetration was probably over 3 inches. The back bulge was cracked nearly all around. The flaking was 23 inches wide abreast the point of impact, but vertically the whole face was flaked off between this and the points of impact of the preceding shots; and there was further flaking above points 3 and 4.	Projectile broken up.

The first four rounds constituted the government test. The fifth round was made at the suggestion of the representative of the makers. The details of this trial are derived from the London *Engineer* and appeared in the issue of April 12, 1901. In the issue of April 19 there appeared the following letter:

OPENSHAW ARMOR PLATE.

MESSIEURS.—Veuillez nous permettre de vous presenter, au sujet de l'essai de plaque relaté dans l'ENGINEER du 12 courant, page 377, l'observation suivante.

Sans contester l'excellence de la plaque d'Openshaw Works, essayée le 21 Fevrier dernier avec des obus de 6 pouces Holtzer, il nous semble qu'il eut été correct d'indiquer aussi l'age de ces projectiles, car il y a douze ans au moins qu'ils ont été fabriqués; à une époque où les plaques à face cémentée et rempié, genre Harvey, n'étaient pas encore inventées.

Or les perfectionnements de nos projectiles, ayant suivi de près, ceux qui ont été apportés aux plaques, il en résulte que des essais, comme celui que nous reproduisez, ne peuvent qu'induire en erreur vos lecteurs, sur la situation vraie et actuelle des choses, si ils ne sont pas accompagnés de l'observation que nous avons l'honneur de soumettre.

Veuillez agréer, M. Messieurs, l'assurance de notre consideration distinguée.

P. MM. JACOB HOLTZER ET CIE.
(H. A. BRUSTLEIN.)

Aciéries et Unieux (Loire) le 15 Avril.

[It is to be remarked that there is no reflection on the quality of the plate in the above letter. The plate was tested and accepted officially, so that its efficiency is not in question. At the same time it may be interesting to know, accepting Messrs. Holtzer's statement, why modern projectiles are not used against modern armor?—ED. THE E.]

TRIAL OF A 4-INCH ARMSTRONG NICKEL-STEEL PLATE, NOT FACE-HARDENED.—This trial took place April 7. The plate was intended for the armored cruiser Lancaster or one of her sisters. Three shots were fired from a 4.7-inch gun. The shells weighed 45 pounds, and were armor-piercing; maker not reported. The initial velocity was 1630 f. s. and the maximum penetration was 1 inch. The compiler hopes to present fuller details of these trials.

EDDYSTONE ARMOR PLANT.—A large armor plant is now in process of erection at Eddystone, near Philadelphia. It is to be called the Gruson Iron Works and is said to be a branch of the Grusonwerke, Magdeburg-Buckau, Germany, which was developed by Herr Gruson but was sold some years since to Herr Krupp, and is now owned and operated by him. The new works will be prepared to furnish chilled armor in the form of turrets and casemates for coast defense. The construction of these works is said to have been brought about by the reported intention of the Board on Fortification to use turrets and barbettes for coast defence in place of disappearing mounts.

BOILERS.

REPORT OF BRITISH BOILER COMMITTEE.—The British Naval Boiler Committee, consisting of eminent naval and civilian engineers and other eminent persons, appointed by Parliament to examine into the question of water-tube boilers suitable for British warships, has made its report to Parliament. The conclusions arrived at are as follows:

"(1) The Committee are of opinion that the advantages of water-tube boilers for naval purposes are so great, chiefly from the military point of view, that, provided a satisfactory type of water-tube boiler be adopted, it would be more suitable for use in his Majesty's Navy than the cylindrical type of boiler.

"(2) The Committee do not consider that the Belleville boiler has any such advantage over other types of water-tube boilers as to lead them to

recommend it as the best adapted to the requirements of his Majesty's Navy.

"(3) The Committee recommend: (*a*) As regards ships which are to be ordered in the future: That Belleville boilers be not fitted in any case. (*b*) As regards ships recently ordered, for which the work done on the boilers is not too far advanced: That Belleville boilers be not fitted. (*c*) As regards ships under construction, for which the work is so far advanced that any alteration of type of boiler would delay the completion of the ships: That Belleville boilers be retained. (*d*) As regards completed ships: That Belleville boilers be retained as fitted.

"(4) In addition to the Belleville type of boiler, the Committee have had under consideration four types of large straight tube boilers which have been tried in war vessels, and are now being adopted on an extended scale in foreign Navies. These are: (*a*) The Babcock and Wilcox boiler; (*b*) the Niclausse boiler; (*c*) the Dürr boiler; (*d*) the Yarrow large tube boiler. (*a*) and (*b*) have also been tried in our own Navy with satisfactory results, and are now being adopted on a limited scale. If a type of water-tube boiler has to be decided on at once for use in the Navy, the Committee suggest that some or all of these types be taken.

"(5) The Committee recommend that the completion of the two sloops and the second-class cruiser fitting with Babcock and Wilcox boilers, and the sloop and first-class cruiser fitting with Niclausse boilers, be expedited, in order that the value of these types of boilers for naval purposes may be ascertained at the earliest possible date. This is especially important, as the Babcock and Wilcox boiler adopted in the ships under construction differs materially from the Babcock and Wilcox boiler as fitted in the Sheldrake.

"(6) The Committee recommend that boilers of the Dürr and of a modified Yarrow type be made and tested at the earliest possible date, under their supervision, with the view of aiding the selection of one or more types of water-tube boilers for use in his Majesty's ships."

The Committee's reasons for preferring water-tube boilers, if a suitable type can be found, are as follows:

(*a*) Rapidity of raising steam and of increasing the number of boilers at work.

(*b*) Reduction to a minimum of danger to the ship from damage to boilers from shot or shell.

(*c*) Possibility of removing damaged boilers and replacing them by new boilers in a very short time, and without opening up the decks or removing fixtures of the hull. These requirements are met by the water-tube boiler in a greater degree than by the cylindrical boiler, and are considered by the Committee of such importance as to outweigh the advantages of the latter type in economy of fuel and cost of upkeep.

Their objections to Belleville boilers are given as follows:

(*a*) The circulation of water is defective and uncertain, because of the resistance offered by the great length of tube between the feed and steam collectors, the friction of the junction boxes, and the small holes in the nipples between the feed collector and the generator tubes, which also are liable to be obstructed, and may thus become a source of danger.

(*b*) The necessity of an automatic feeding apparatus of a delicate and complicated kind.

(*c*) The great excess of the pressure required in the feed pipes and pumps over the boiler pressure.

(*d*) The considerable necessary excess of boiler pressure over the working pressure at the engines.

(*e*) The water gauges not indicating with certainty the amount of water in the boiler. This has led to serious results.

(*f*) The quantity of water which the boiler contains at different rates of combustion varying, although the same level may be shown on the water gauges.

(*g*) The necessity of providing separators with automatic blowout valves on the main steam pipes to provide for water thrown out of the boilers when speed is suddenly increased.

(*h*) The constant trouble and loss of water resulting from the nickel sleeve joints connecting the elements to the feed collectors.

(*i*) The liability of the upper generator tubes to fail by pitting or corrosion, and, in economizer boilers, the still greater liability of the economizer tubes to fail from the same cause.

Further:

(*k*) The upkeep of the Belleville boiler has so far proved to be more costly than that of cylindrical boilers; in the opinion of the Committee this excess is likely to increase materially with the age of the boilers.

(*l*) The additional evaporating plant required with Belleville boilers, and their greater coal consumption on ordinary service as compared with cylindrical boilers.

The Committee recommends that boilers of the Dürr, and of a modified Yarrow type, be made and tested at the earliest possible date. The Committee also recommends the careful trial of the vessels now being fitted with the Babcock and Wilcox and Niclausse types.

COAST DEFENSE.

UNITED STATES: APPROPRIATIONS FOR FORTIFICATIONS.—The following appropriations and provisos are contained in the Fortifications Appropriation bill which became a law March 1, 1901: Gun batteries, $1,615,000; searchlights for New York Harbor, $150,000; range and position finders, $150,000; land for fortifications and coast defenses, $200,000; protection, etc., of fortification, $100,000; fortifications, Galveston, Texas, $992,000; plans for fortifications, $5,000; tools, etc., to be furnished by the Eng. Dept. for the use of troops, $25,000; sea walls and embankments, $100,000; submarine mines and necessary appliances for our principal seaports, including San Juan, Porto Rico, $50,000; steel for seacoast guns, price not to exceed 21 cents per pound, $476,000, provided that in the discretion of the Secretary of War a portion of this money may be used for the purchase of material for steel-wire seacoast guns; carriages for mounting seacoast guns, $485,000; reserve projectiles and explosives, $600,000; rapid-fire guns, $477,908; carriages for 12-inch breech-loading mortars, $71,000; 8-, 10- and 12-inch guns, $414,536; proof of guns, $12,100; proof of seacoast mortars, $5,000; armor plates and deck plates for testing projectiles, $24,000; ammunition for artillery practice, $117,000; armament chests, $7,300; machine guns, $50,000; range finders, etc., $35,000.

Implements and equipments for service, and also for mounting, repairs, care and preservation of armament and of range finders, including $25,000 for care, repair, and preservation of fortifications in the harbor of Galveston, Texas, $50,000; material, tools and implements for battery mechanics,

$92,680; mountain guns, $77,000; rifles, siege, 5-inch B. L., $18,880; carriages for same, $26,990; sights for cannon, $23,000; fuses and primers, $25,000; ammunition of all kinds, $300,000; inspecting instruments, $5,000; subcaliber tubes, fittings and ammunition for seacoast artillery practice, $212,000.

Proving ground, Sandy Hook, N. J., $99,067; Watervliet Arsenal, West Troy, N. Y., for completing repairs and alterations on gun shops, including new cornice, $10,000; gallery drive, $12,000.

The Board of Ordnance and Fortification, $100,000; "One additional member shall be added to the said Board of Ordnance and Fortifications, who shall be an artillery officer of technical ability and experience, to be selected by the Secretary of War:

"Provided, That before any money shall be expended in the construction or test of any gun, gun carriage, ammunition, or implements under the supervision of the said board, the board shall be satisfied, after due inquiry, that the Government of the United States has a lawful right to use the inventions involved in the construction of such gun, gun carriage, ammunition, or implements, or that the construction or test is made at the request of a person either having such lawful right or authorized to convey the same to the Government.

"To enable the Secretary of War to make a comparative test of destructive energy between the Gathmann torpedo gun now at Sandy Hook and the Army twelve-inch service rifle, such tests to be made against two similar targets representing the side construction of the latest type of battleship; each of said structures to be faced with Kruppized armor plate eight feet by sixteen, and twelve inches thick, and at least ten shots to be fired from the Army rifle against one structure and one or more Gathmann torpedoes against the other; for the erection of the structures and the purchase of materials, armor plates, ammunition, mount for the torpedo gun and other necessary expenses of such test, $50,500.

"To enable the Secretary of War, in his discretion, and if in his judgment it will be for the best interests of the Government, to purchase the U. S. Letters Patent, numbered 622,479, issued April 4, 1899, covering the Isham high-explosive shell, designed for firing high explosives and carrying the same through armor plate, invented and now owned and controlled by Willard S. Isham, and also to purchase the entire and exclusive right for the United States to manufacture and use the high explosive 'thorite,' invented and now owned and controlled by Doctor Hiram P. Tuttle, $100,000: Provided, That all formulæ, data, and facts related to said process and necessary to the successful manufacture of said 'thorite' shall be placed in the possession of the Secretary of War, and to his satisfaction, before any payment for the same shall be made: Provided further, That before any money shall be expended in the purchase of said patent the Secretary of War shall be satisfied, after full investigation, that the Government of the United States shall have a lawful right to use said patent, without the use of same being an infringement upon any prior invention, patent, or pending application for patent covering said invention or any material part thereof.

"That as material purchased under the foregoing provisions of this Act shall be of American manufacture, except in cases when, in the judgment of the Secretary of War, it is to the manifest interest of the United States to make purchases in limited quantities abroad, which material shall be admitted free of duty."

UNITED STATES: TORPEDO BOAT DEFENCE.—The Naval Torpedo Boat Board, under the presidency of Captain G. A. Converse, U. S. N., has decided to visit the various points on the Southern coast which have been mentioned as convenient and safe places for the torpedo stations required by the Navy Department. Among the points to be visited will be Savannah, Charleston, S. C., Port Royal, Pensacola, possibly Richmond, Va. Following the southern trip a similar investigation of northern locations will be made, and the report of the Board will indicate the advantages and disadvantages of the sites selected and recommended.—*Army & Navy Journal*, May 18, 1901.

GERMANY: COAST DEFENCE SYSTEM.—The system of Coast Defence in Germany has been most carefully worked out. No cast-iron rules covering the entire extent of the coast have been laid down but each part is treated according to the requirements of the case. The naval ports of Kiel and Wilhelmshavn, and adjacent coasts and waters, and the entrances to the Weser and Elbe, with their approaches and surroundings, are entirely controlled by the Navy. A vice-admiral is commander-in-chief of each of these four districts and of all the defences, afloat and ashore; and, by a recent imperial decree, he is given full and unlimited command within the boundaries of his district, which boundaries are carefully defined. Beyond the limits of the naval districts and in the lesser ports the general commanding the district is similarly in supreme command. This exact definition of authority cannot fail to result in harmonious working of the general defence, if the authority is wisely exercised.

COMMUNICATIONS.

NOTE.—Under this head will appear notes on Signaling, Telegraphy, Ocean Cables, Carrier Pigeons, etc.

WIRELESS TELEGRAPHY IN THE U. S. NAVY.—The Board of naval officers, headed by Captain Chadwick, appointed to make a full investigation and report on wireless telegraphy, has completed its work and submitted its report to Admiral Bradford, chief of the Naval Bureau of Equipment, having charge of this subject. It had been expected that the inquiry would last through the summer, and the Navy Department has been somewhat surprised at the promptness with which the board has been able to reach its conclusions. Although the findings are not made public, it is known that the board reports on the entire feasibility of the system, and recommends that it be adopted and that the present system of using carrier pigeons for messages between naval points be abandoned.

With the report the board submits the results of an extended conference with Senor Marconi, the Italian inventor, concerning the general subject of wireless telegraphy. It is understood that Marconi made no proposition regarding his own system, and that the board secured his views as an expert on the general subject. There is no finding in favor of any particular system, but a general treatment of all systems. The board has no doubt that wireless telegraphy will prove a valuable adjunct for the navy.—*Baltimore American*, May 8, 1901.

WIRELESS TELEGRAPHY IN THE BRITISH NAVY.—The Majestic, flagship of the Channel Squadron, had a remarkable experience in the matter of signalling by means of wireless telegraphy while on the voyage from

Portsmouth to Berehaven, where she arrived on April 22. Messages were exchanged up to a distance of 90 miles between the Majestic at sea and the Hector in Portsmouth Harbor on April 20 until at 11.45 p. m. the telegraph communication was unexpectedly suspended. The instruments on board the Majestic were then adjusted to send a message to Portland, and to the surprise of the signalling staff that station was found to be talking to the Hector, the latter explaining that it had suddenly lost touch with the Channel Squadron flagship owing to the breakdown of the apparatus key. The distance at which this information was taken was 103 miles as the crow flies, a record so far as the naval service is concerned. Probably the space thus covered would have been exceeded had not the Diadem at Plymouth interrupted, thinking that the Majestic was calling her. The achievement must be extremely gratifying to the naval officers who have worked so assiduously in the development of the system of wireless telegraphy for signalling purposes at sea, and likewise to the trained signalmen of the fleet who show an intelligent interest in the experiments and have learned to manipulate the apparatus expertly. An order has been issued in the Channel Squadron that only the flagship is to keep her wireless instruments ready for sending and receiving in harbor, the other ships disconnecting their coherers.—*United Service Gazette*, May 4, 1901.

WIRELESS TELEGRAPHY IN THE SPANISH NAVY.—Wireless telegraphy is attracting considerable attention in Spain. Experiments are being made with a system invented by Colonel Cervera. With wireless telegraphy it is hoped to establish communication with the Balearic Islands and the Spanish possessions in Africa. The Marquis of Portago, director-general of communications, has asked the government for funds to carry on the experiments.

CONSTRUCTION.

NOTE.—Under this head will appear notes on Design, Materials, Sheathing, etc.

TESTS OF FIREPROOFED WOOD.—The Assistant Secretary of the U. S. Navy has sent to the Senate the report of Assistant Naval Constructor H. G. Gillmor, U. S. N., who supervised the tests of fireproofed wood made at the Washington Navy-yard last December. The tests were made to determine whether or not wood taken from different parts of the torpedo boat Winslow had, in the five years since it was treated, lost its fireproof qualities. The wood was white pine, ash, and butternut, and four different kinds of tests were made, the stove test, hot-plate test, hot-rivet test, and splinter test. In the first, shavings and kindling wood saturated with kerosene were burned with the pieces of fireproofed wood laid on top. In the bottom of the stove was placed waste saturated with kerosene. After the shavings and kindling were entirely consumed, the fireproofed wood ceased to give off any flame or glow, and was found charred from one-eighth inch to three-sixteenth in. from the surface, but entirely sound and free from charring inside. In the hot-plate test a steel plate, 9 in. wide, 2 ft. long, and ½ in. thick, was heated until bright red on the surface, and immediately on removal from the furnace a specimen of each kind of fireproofed wood was laid on it and left so long as there was any flame from the wood. The ash specimen first ceased to give off flame, then the butternut, and the pine last. All were found

charred only on the surface, free from ash and with no tendency to glow. In the hot-rivet test rivets were heated in the furnace to a driving temperature, and laid upon the surface of the specimens. At first some flame was given off, but this soon disappeared, the charring was limited, and there was no ash where the rivets were in contact with the wood. In the last test splinters were held over the flame of a Bunsen burner burning coal gas. Flame was given off while specimens were in contact with the fire, but ceased at once when removed, and no ash formed.—*Railroad Gazette.*

FIREPROOFED WOOD IN BRITISH NAVY.—According to the *Pall Mall Gazette*, the naval authorities have decided to remove the non-inflammable wood from the new armored cruiser Cressy. Nor, says the paper, will this material be used in any other British warships. The intention of fitting it in the Kent has been abandoned, corticine-covered steel being employed instead for the 'tween-deck fittings. An oaken covering is being given to quarter-deck and forecastle, as this material is much better than bare steel for the men to get about on when at sea. But no wood is being used in places where its presence is considered dangerous. Experience has proved that where wood is bolted to steel, as it is on the upper decks of the new British ships, it will neither burn nor splinter. The British *United Service Gazette*, on the other hand, learns that "a report about the removal of non-inflammable wood in the Cressy was based upon the fact that in order to facilitate the ship being commissioned, and to avoid waiting for the drying and repainting of the non-inflammable wood, it was decided to replace some of it—a very small proportion, and principally lathing for electric wires—with ordinary wood on the upper deck only. Nothing is being removed from between decks, where the greater part of the non-inflammable wood is. We are also informed that the wood is being used on a number of the new warships under construction, and that means are being taken at the various shipyards to prevent the wood being worked into the ships whilst it is damp, this dampness, which is easily prevented, being the sole cause of any trouble experienced."—*Army & Navy Journal*, May 4, 1901.

TRIAL OF WATER-TIGHT COMPARTMENT ON THE KENT.—A trial of water-tight bulkheads, doors and fittings took place recently on board the British armored cruiser Kent which was launched on March 6. One of the main engine compartments was closed and water admitted to the estimated amount of one thousand tons. All the doors and bulkheads appeared to be perfectly tight, and after pumping out the water no sign of strain or deformation was observable.

ELECTRICALLY DRIVEN VENTILATING FANS.—Naval Constructor W. L. Capps, U. S. N., in his report upon the battleship Alabama, advises the use of electrically driven fans in each compartment in preference to steam fans and long ventilating pipes. The ventilation of the Kearsarge is more satisfactory than that of the Alabama on account of the difference in the system. Mr. Capps says in his report that there can be no question as to the results obtained in the two vessels, and as the electrically-driven fans proved themselves so much better than steam-driven ones, he strongly recommends that electric driving be substituted for steam in all future construction. The adoption of electric driving, however, ought only to be one step towards the complete revision of our ventilating apparatus. The compiler is not familiar with the systems on the Kearsarge and Alabama, but the ventilating of previous ships is certainly wofully defec-

tive. The ventilating trunks were unsightly and much in the way. The air discharge took place in a way to obstruct, rather than assist, the natural air currents. The louvres were all of one size, regardless of distance from the blower, and of a design which seriously interfered with easy circulation and wasted much power; the similarity of size of course caused all of the air to flow out of the louvres near the blower where the pressure was highest; from the distant ones not a breath of air. The supply of fresh air, in some cases, was drawn from a ventilator situated over a fire or engine room hatch and drew in the heated air, pumping it down against gravity and to the discomfort of those below, thus doubly losing in efficiency. The long ventilating trunks pierced water-tight bulkheads and double bottoms and often menaced the safety of the ship, the bulkhead valves adding little to security while they nearly destroyed the usefulness of the pipe as an air-duct. Places like the engine-room, dynamo-room, and workshops are hard to ventilate but a great deal more can be done than has been attempted. If the steel bulkheads, floors, ceilings, etc., be covered as far as possible with a non-conductor of heat, much of the difficulty is obviated. These surfaces become heated by conduction, by radiation, and by escaping steam and heated air and they disperse by radiation and conduction a great part of this heat through the air. As at present fitted no reasonable amount of air can keep these compartments at a comfortable temperature. With the stationary surfaces covered by a non-conductor of heat a moderate amount of fresh air supplied and diffused at the *bottom* of the compartments, so as to aid and not obstruct the natural currents, might achieve success. The defects of ventilating apparatus are not so noticeable in temperate climates, even in summer, as the sea water is comparatively cool, but in the tropics every defect is at once painfully apparent.

ALUMINIUM THERMIT.—On Wednesday Dr. Hans Goldschmidt, of Essen, gave, at 29A, Gillingham Street, Westminster, a very successful demonstration of welding by means of his aluminium thermit before a large audience of leading engineers, metallurgists, and chemists. The process has repeatedly been mentioned in our columns, and was described on pages 386 and 450 of our last volume. A mixture of powdered aluminium and iron oxide constitutes the thermit, which is kept in soldered boxes, and can be bought at the rate of less than 1s. per pound. This mixture is perfectly harmless, and molten iron may be poured into it without starting any reaction. If, however, a primer, consisting of powdered aluminium and some peroxide, is applied, the reduction commences at once. This was the first experiment. A little of the ignition powder is dropped into a crucible and lighted with a common fusee. It flares up, and when thermit is gradually added, the whole mass begins to boil. A minute, or less, later, the fused alumina which floats on the top may be poured off, and the molten iron then made to follow. To show the intense heat, a bottomless crucible was placed on the top of an iron plate ½ in. or more in thickness. The reduced iron bored a hole through the plate so quickly that the plate could be handed round before the heat had spread to the edge. Then two tubes, 2 in. in diameter, were welded together endways, a box of sheet iron being loosely fitted round the joint, and another box, packed with sand, outside this. In this case the heat alone acts, the reduced iron is not wanted really. Therefore, some of the alumina is poured out first and directed against the tubes, surrounding them with a protective layer of this oxide. After a minute

the bolts which clamp the tubes together are tightened by, perhaps, ⅛ in.; a minute or two later the box frames are knocked off, and the iron and alumina also come off neatly without the slightest trouble. A beautiful weld results. An experiment with a larger tube was equally successful. Then two heavy tram rails were welded together. Boxes packed with sand had been placed about them, and the rails were held in position by two bolts, one on each side. Above the joint stood a crucible, taking about 25 pounds of thermit and closed below by a thin plate of iron. In this instance, a little ignition powder was simply sprinkled on the top of the thermit and lighted in the usual fashion by means of a fusee. The mass soon burned its way through the under plate, and a minute or so afterwards the bolts could be tightened. That practically finishes the weld. As no fishplate nor drilling is required, the Allgemeine Thermit Gesellschaft, of Essen, can weld rails on the terms usually paid for making a good joint. The process has been adopted in a good many towns, and has given great satisfaction. Some fine specimens of work done by aluminium thermit were exhibited, among them a welding of cast iron and steel, and many test bars, none of which had in the testing machine ever given way at the joint. The aluminium applied is the commercial aluminium of American and other works, of 98 per cent and more. The powdering and mixing, the manufacture of the partly magnesia-lined crucibles and box frames are all done at the Essen Works. The alumina which results as a by-product is an exceptionally pure corundum, which is sold to emery works. Messrs. Fox, Thicknesse, and Hull, of 32 Victoria Street, S. W., are representing Dr. Goldschmidt in the United Kingdom. —*Engineering*, London, May 3, 1901.

ALUMINIUM: WELDING.—A firm of Hanau, Germany, has succeeded in welding aluminium without the use of any metal, solder, or acid, says the *Scientific American*. No seam can be detected, and the welded pieces can resist blows and temperature variations as well as if there were no joint. The process is a secret one.

GUNPOWDER AND EXPLOSIVES.

EROSION OF GUNS.—This is a matter attracting the greatest attention in Great Britain and Italy, where nitroglycerin powders still continue to be used. The subject was treated at some length in the Notes of PROCEEDINGS *No. 97*, but some further information is at hand confirmatory of the general correctness of the theory therein advanced. As a preliminary to discussion it is desirable to present some of the facts in regard to erosion.

In forwarding a brief of the records of a 5-inch caliber gun in use at Indian Head Proving Ground, Lieutenant W. S. Turpin, U. S. N., says:

"This is a station gun and is particularly open to erosion from the fact that during the proof firing of the gun a pressure gauge was put by some mistake in the mouth of the cartridge case. This gauge scored the rifling very materially, so much so in fact that the gun was never sent out into service but was returned here to be used as a station gun. So far as you can see by close inspection there appears to be very little erosion. The gun has had a total number of rounds with smokeless powder of 719, divided as follows as regards pressures:

Pressures.	Rounds.	Pressures.	Rounds.
Below 5 tons	180	13 to 14 tons	48
5 to 7 tons	38	14 to 15 tons	85
7 to 8 tons	21	15 to 16 tons	86
8 to 9 tons	42	16 to 17 tons	11
9 to 10 tons	44	Over 17 tons	5
10 to 11 tons	44		
11 to 12 tons	44	Total	719
12 to 13 tons	53		

"Something over half of these rounds were fired at low pressures and low velocities; but the other 308 were fired at or above service conditions. The average pressure for this gun is between 14 and 15 tons. In addition to the above number of rounds this gun has been fired 140 times, using brown powder. I have not taken these into account in the table of pressures and rounds above given.

"This gun has recently been up at the gun factory and has been thoroughly cleaned and lapped out. The erosion does not seem to be of sufficient magnitude to reduce the velocities in the gun and is confined entirely to the grooves. The lands do not appear to have suffered in the least."

Lieutenant Dawson (late R. N.), a British ordnance engineer, in a paper read before the British Society of Arts, gives the following table of erosive action in a 6-inch gun using cordite:

EROSION IN A GUN USING CORDITE WITH A VELOCITY OF ABOUT 2500 F. S.

Distance from muzzle in inches...	234.5	232.	230.	228.	225.	222.	219.	216.
Wear of gun per round with special gas-check, inches	.0034	.0024	.002	.0017	.0013	.001	.0008	.0007
Wear of gun per round without gas-check, inches	.007	.0042	.0041	.0037	.0033	.0024	.0018	.0012

In regard to erosion Lieut. Dawson says:

"Nitrocellulose powder has the great advantage of being capable of producing in modern artillery the highest possible ballistics with the least possible amount of wear to the gun; and therefore at the moment its introduction should be treated from a most serious standpoint. It is, I think, well-known to all of you that the temperature of explosion of cordite is practically double that of nitrocellulose powders. This great difference in temperature of explosion has a great bearing upon the wear of guns, for with so high a temperature of explosion as cordite, far exceeding the melting point of steel, it is not reasonable to expect a gun to last many rounds, and especially if large charges are used, developing heavy volumes of gas. Now, in order to obtain high ballistics, it is very necessary to develop very large quantities of gas, with the view of keeping the volumes of expansion of the gas at the higher pressures as long as possible, and continuing these pressures to the muzzle of the gun. If cordite is used, having this very high temperature of explosion, these volumes of gas at the high pressure must of necessity affect the bore of the gun, especially at the commencement of the rifling. The nature of the wear of the bore with cordite is also very serious, taking the form as it does at the commencement of erosion of very thin fine lines, which develop as the rounds are continued, completely washing away the surface, and quite abnormally enlarging the seat in the gun, where the shot is rammed home. This, after a few rounds, allows the shot to be

over-rammed, increasing the volume of the chamber, which, in its turn, diminishes the pressure, reducing the energy of the gun, and varying the velocities, and therefore the range, accuracy, and, indeed, every point which to the gunner is an absolute essential. Furthermore, the wear of the bore of the gun prevents the proper centring of the projectile at starting, causing it in many cases to gyrate when it comes under the influence of the rifling. In guns of low power using cordite, where only small charges are required, the effect is, of course, much less than in guns using large charges; but I contend that as it is necessary for modern artillery, except that for special purposes, to have the highest possible ballistics, it is of primary importance to use a powder which, as far as possible, gets over the objections I have just mentioned. The effect of using cordite in, say, 6-inch high-powered guns, having velocities of 2800 to 3000 feet, is to entail a loss of some 500 to 600 foot-seconds, after about 200 rounds have been fired, representing a loss of energy of about 34 per cent, owing to the development of erosive effects. Furthermore, these velocities vary very materially with the temperature, and in some guns as much as 3 feet for every degree Fahrenheit. The question really comes to this: that if cordite is used, no higher velocity than, say, about 2500 feet can be obtained for any reasonable number of rounds, whereas with nitrocellulose powder, velocities up to and exceeding 3000 feet can be easily obtained, without the objections attendant upon the use of cordite, I therefore shall continue to urge that a nitroglycerin powder is not suited to modern artillery, and that any country continuing to use it must of necessity be at a serious disadvantage with a country making use of a nitrocellulose powder. The effects in other countries of powders containing from 10 to 25 per cent of nitroglycerin have, from an erosion point of view, been superior to those containing a higher proportion, but with such a powder a much larger charge has to be used in order to obtain the same ballistics, and the saving in erosion is not so great as one would naturally in the first instance think. A certain increase in the life of the gun can be obtained by using an efficient gas-check, and my diagram [omitted; it may be plotted from data given in the table at the beginning of Lieut. Dawson's remarks] shows the advantage of using the special form of gas-check shown [omitted; rotating band broadened and rear part contains two annular recesses apparently filled with obturating material and covered with a thin plate ring] thereon for making a metallic seal of the gas at the commencement of the travel of the shot and continuing it throughout the bore. The advantage of using such a gas-check is to lengthen the life of the gun, but it will have much more valuable results if used in connection with nitrocellulose powder than with a powder containing any percentage of nitroglycerin.

"As an example of the small erosion in guns when using a nitrocellulose form of powder, I would refer you to an experiment carried out in a Krupp 6-inch gun, in which—after some 534 rounds, 76 of which were fired with prismatic powder [brown] and ballistite—the dimensions of the bore were such that notwithstanding the damage done with the 76 rounds of powder other than nitrocellulose, the dimensions of the gun came within the acceptance limit of a new gun. It is only right, however, to add that in this gun the velocities were not very high, being only 2300 foot-seconds; but even this velocity is higher than that of the majority of 6-inch guns we now have in the service.

"The usual objection put forward to the introduction of a nitro-

cellulose powder is that it will not keep on foreign stations with variable climates. This I must state is erroneous; I have results of nitrocellulose powders stored in some of the hottest climates, and these have proved in every way satisfactory, both chemically and ballistically, when fired in guns. Some of the great German makers have had this powder under various heat tests for many years, and have reported to me their definite opinion that nitrocellulose powders, if properly made, are to be relied upon not to deteriorate any more than cordite and other nitroglycerin powders when subjected to variable climatic influences.

"I have heard it sometimes said abroad that better ballistics can be obtained in a rifle using nitroglycerin powders, as against cartridges made up of nitrocellulose powders. This belief is unfounded, as I have been able to obtain from rifle cartridges of the smallest size used in Europe higher ballistics with nitrocellulose powder than with cordite at normal temperatures, say between 60 degrees and 80 degrees Fahrenheit.

Having laid particular stress on the importance of nitrocellulose powders, because they are the only ones by which we can obtain constant high velocities up to say 5000 foot-seconds, I will now call your attention to my dangerous space diagram, showing the difference between the effect of firing with a high velocity and a low velocity." [This diagram is omitted; it is not germane to the present investigation. The subject of danger space, etc., will be much more fully treated than by Lieut. Dawson in a future number of the PROCEEDINGS.]

The following is from the *United Service Gazette* of March 30, 1901:

"Owing to the serious erosion in guns which is set up by cordite and other almost similar explosives they have been abandoned abroad, and a committee in this country, under the presidency of Lord Rayleigh, has been at work under the following terms of reference:

"(*a*) To carry out trials with a view to ascertaining what are the best smokeless propellants for use in existing guns of all natures, and in existing small arms.

"(*b*) To report as to whether any modification in the existing designs of guns is desirable, with a view to developing the full powers of any propellant which may be proposed.

"(*c*) To carry out trials with a view to obtaining a high explosive for shells which can be fired from all natures of guns and howitzers with as much safety as lyddite, with greater certainty of detonation, and with greater explosive effect.

"Now, Sir Henry Brackenbury, Director-General of Ordnance, acting under the Secretary of State, has directed a letter to all manufacturers of propellants and high explosives on the Home Office list, inviting them to submit, in confidence, any preparations under either head which give reasonable promise of proving more efficient than the present Service explosives.

"The committee have suggested the establishment in Great Britain of an institution similar to the Centralstelle fuer wissenschaftlichtechnische und untersuchungen, founded two years ago as a limited liability company, near Berlin. This organization was established for the exclusive benefit of a limited number of manufacturers, for the purpose of exercising control over their works, as regards the quality of the output, and to carry out such investigations, experiments, and researches as may serve to secure the highest efficiency and perfection for their manufactures. The interested firms submit their individual experiments to the

Centralstelle, where all the information thus collected is sifted and examined. Any new discovery which the Centralstelle holds to be of sufficient importance is communicated to those of the works interested in the Centralstelle to whom it may be useful."

Sir Hiram Maxim has taken out a patent in the manufacture of explosives (patent dated March 3, 1900) which is briefly described in the report of patents as follows:

"An explosive composed of nitrated guncotton pulp, ground to great fineness under edge rollers, together with 2 per cent to 15 per cent of resinous material. This compound is then pressed into blocks of suitable size for use in ordnance. The object of the added resinous matter is to prevent or diminish erosion, which it does through its richness in carbon. The carbon di-oxide which is given off from the present cordite, and which erodes the gun barrels, is thus displaced by carbon mon-oxide."

The following, which I derived from an article in *Arms & Explosives*, was published in the Army and Navy Year Book for 1895:

"Scattered through the literature of explosives may be found data for the combustion temperatures, or calorific intensities, of gunpowder, guncotton, and nitroglycerin, which vary between the following limits:

Black gunpowder .....3000° to 4000° C. (5432° to 7232° F.)
Guncotton .....5000° to 6000° C. (9000° to 10,800° F.)
Nitroglycerin .....7000° to 9000° C. (12,600° to 16,200° F.)

"These data appear the more remarkable inasmuch as the lowest temperature cited is above the melting point of most gun-metals. Von Winch has recently called attention to an error into which many observers have fallen in respect of these data—viz., the assumption that the specific heat of the products of combustion is independent of the temperature. He shows that this is not the case, and then, by means of a newly developed expression for the specific heat, he obtains, as the combustion temperatures, or colorific intensities, of the above explosives the following values:

Black gunpowder .....1874° C. (3405° F.)
Guncotton .....2516° C. (4561° F.)
Nitroglycerin .....3005° C. (5441° F.)

From the preceding data it appears that the chief cause of erosion is certainly not pressure, for with high pressures in guns using pyrocellulose powders the erosion is insignificant. It is not caused chiefly by temperature, for powders containing but a small percentage of nitroglycerin show very marked erosive qualities. It is not chiefly caused by escape of gas past the projectile through inefficient obturation of the rotating band, because it is almost nothing when pyrocellulose powders are used with guns and projectiles that give excessive erosion with nitroglycerin powders under the same conditions of pressure and velocity. It is true that an efficient gas-check decreases the erosion with the latter type of powder. But it is admitted by all that the use of a gas-check is only palliative and I doubt if it is of any use until after the erosion has made considerable progress, after which time the gas-check closes the gap around the projectile which the regular rotating band is no longer able to do. For of course no one doubts that the rush of gas past the projectile, *especially if this gas is rich in oxygen*, will undoubtedly cause some erosion. The experiments of Lieutenant Dawson are proof of this, but

plenty others may be cited. But there is nothing to show that a special gas-check would be of great value in guns using pyrocollodion powders. The present rotating band seems to act efficiently. In the case of cordite and Noble's powders (ballistite, etc.) the gas rushing past the projectile is rich in oxygen and it is brought in intimate contact with the metal of the bore, some of which has been burnished bright by the previous projectiles and so is ready for easy oxidation. There remains then but the chemical aspect of the question, a view of which was briefly presented in the last number of the PROCEEDINGS. Whether the chemistry therein given is perfectly sound or not, the compiler believes that the central idea advanced, which is that the principal cause of erosion (where it is of serious amount) is oxidation of the metal of the bore, is the true solution of the problem. The causes of erosion in guns using pyrocellulose are not here in question. The small amount that exists is probably due to a combination of chemical action and imperfect obturation and perhaps the latter is very much the greater factor.

Sir. A. Noble's plan of introducing water in the powder case in order to lower the temperature of combustion and so reduce the erosion (see "Special Powder Case to Reduce Erosion" in notes on Ammunition, page ——) seems wholly impractical and theoretically wrong. Such a contrivance is clumsy and, if recent investigations into the oxidation of iron at low temperatures (see "Rusting of Iron," page 195, PROCEEDINGS *No. 97*) give results which are true for high ones, the introduction of water is likely to add to the trouble rather than to lessen it.

DETONATORS WITHOUT FULMINATE OF MERCURY.—A German chemist, Dr. L. Wohler, has patented a method of rendering detonators less expensive and more efficient by substituting for part of the fulminate of mercury a quantity of trinitrotoluol. Trinitrotoluol is not so expensive as the fulminate of mercury, and not so much of the former substance has to be used as the latter. An example of the material for insertion in the detonator tube is as follows: Trinitrotoluol, 0.1 to 1.3 grains, according to the effect desired, is first inserted, and above that 0.1 to 0.3 grain of mercury is distributed. English patent date is February 16, 1901.—Chiefly from *Arms & Explosives.*

EXPLOSIONS OF MAGAZINES ON THE SPANISH SHIPS AFTER SANTIAGO.—There are probably many people who still believe that the Maine was destroyed by the explosion of her own magazine through negligence or accident. Some foreign writers have produced small volumes to explain away the manifest difficulties which beset such a theory when confronted with the facts of the situation, particularly the ascertained condition of the wreck. The officers of our service have very generally contended that while the watchfulness and discipline aboard our ships made such an accident almost impossible, the condition of the wreck after the explosion was such as to preclude the possibility that the cause was due to magazine explosion, on the ground that an internal explosion of gunpowder taking place below water would not drive the sides or bottom outward but force the decks up. Water, which yields so easily to slow movements, is like a mountain of granite to sudden blows like that given by powder pressure against the sides and bottom of the ship. If the water surrounding the Maine for a hundred yards in every direction were to have been replaced by a vast expanse of granite rock fitting her bottom with the same closeness and exactitude as the water, the resistance to forcing out of the sides by an internal gunpowder explosion would not have been greatly increased.

In my opinion a very conclusive case could be made out upon theoretical grounds based upon general knowledge of the action of explosives; but that is beside my present purpose which is to cite practical parallels. The three Spanish armored cruisers, Infanta Maria Teresa, Viscaya, and Almirante Oquendo, which were stranded and burnt in the naval action off Santiago, had many points in common with the Maine. They were almost exactly the same size as the Maine, differing from her less than three per cent in normal displacement and general dimensions, and having similar armor belts and protective decks. Moreover, the principal magazines and shell rooms were in the same general locations and contained about the same amounts of powder and other ammunition, so far as we can ascertain.

All the magazines and ammunition rooms of the Oquendo and Viscaya blew up, and some of those on the Maria Teresa, the others being flooded. What was the result? The decks were forced upward. In the case of the Maria Teresa, even the decks were not seriously wrecked. In the Oquendo and Viscaya I was unable to examine the condition of all the lower decks as some were submerged. The protective deck of both these ships, however, was in plain sight above water. The force of the explosions had lifted it bodily forward and aft where it covered the magazines, shearing the ends of the beams at the ship's sides and ripping it from its other fastenings at sides and bulkheads. So far as I recollect no hole was made in it anywhere. Some of the bulkheads, and perhaps all, surrounding the magazines and compartments immediately adjacent were blown down and wrecked in various ways. And yet not one hole in the sides could be found. And further—notwithstanding the destruction of the decks and beams which removed almost all the interior forces holding the ships' sides together—there was no exterior indication that the explosion had taken place. So far as I could see, and I looked most carefully, there was no distortion of the lines of the hull, not even a bulge. Above water the explosion of the torpedoes had ripped off many plates in the bows of these ships. But even here the damage was less than might have been expected, for the injury was confined almost wholly to the plating, the frames being very little injured.

The groups of magazines at opposite ends of the ships exploded separately; of these explosions I saw two—one on the Viscaya at close range, while we were picking up her crew, and just after Captain Eulate had been brought on board and was being taken below. It was a most impressive sight. A vast cloud of white smoke gushed up with enormous velocity to a height of many hundred feet and then spread out, forming a figure like a great palm tree. Those who happened to be looking at that part of the Viscaya said the white smoke was preceded by a tongue of flame and thin smoke which shot up as high as the masthead. The others of us who were an instant too late saw only the after rush of smoke. Almost simultaneously with the appearance of this smoke column—which I conclude came through a very large hatch—the smoke puffed up all around the deck and for a moment hid that end of the ship almost completely.

The results of the explosions, coinciding with our previously conceived ideas, are to my mind practically conclusive as to the ordinary effects of magazine explosions in ships. The very moderate damage from the explosion of several torpedoes (at least three), quite close together, in the bow of the Viscaya, make me exceedingly sceptical as to the great

destruction to be expected from high explosive shells in future naval warfare. The radius of destructive effect was so strikingly limited in this case that I cannot see how a single shell, containing perhaps not one per cent as much explosive, can be so hideous a missile as it is, in Europe, popularly held to be. The stories of the condition of affairs found upon old ships after recent firing experiments may be wholly correct; but if so I believe the same condition is to be expected from the explosion of an equal number of shells charged with gunpowder. The high-explosive shell charge breaks up the shell into so many fragments that they must act like shrapnel.

The results of the torpedo explosions referred to above seem fully to sustain Professor Alger's contention that the effects of the explosion of a torpedo in a tube above water would be chiefly confined to the compartment containing it.

GUNS: FIRING.

NOTE.—Under this head will be given notes referring to firing tests of guns, target practice, special practice, accidents to guns while firing, etc.

TRIAL AND DESCRIPTION OF 5-INCH, 50-CALIBER GUN, M'99, FOR U. S. NAVY.—The following is furnished by Lieutenant W. G. Turpin, U. S. N., assistant inspector of ordnance, Indian Head:

This gun is of a new design, being approximately 50 calibers in length and designed to give 3000 f. s. velocity with smokeless powder; chamber pressure, 17 tons.

The new features of the gun are: the return to the plastic obturating pad and the consequent discarding of the cartridge case; and enlarged powder chamber, the volume being 1186 cubic inches as compared with 657 cubic inches in the 5-inch, 40-caliber gun.

The breech mechanism is of the Vickers type. This mechanism is on the slotted screw system, with three blanks and six threaded segments. Each segment of a set of three is made with a different radius, the difference being about equal to one and one-half times the depth of the thread. This arrangement allows the block to have a holding surface of two-thirds its circumference, instead of one-half, as in the older style, and consequently permits the use of a shorter breech block with equal strength. The block is carried on a brass arm which is hinged to the jacket, and when the block is closed this arm is close up against the rear face of the gun. A lug with a slotted screw on one end of this arm carries the block and through this lug the mushroom stem is carried, the latter being secured by means of a nut. The primer seats in the rear end of the mushroom stem. The lock is carried by the carrier arm, and is automatic so far as ejection of the primer is concerned. Both electric and percussion gear is fitted.

The mechanism is operated by means of a lever pivoted to the carrier arm. The motion of this lever is transmitted to the block by means of worm gearing and a connecting rod. This latter rod operates the lock mechanisms. The lock can be cocked without opening the breech. As in all recent types the gun is trunnionless and recoils in a sleeve. The recoil is taken up in the usual manner. Telescopic sights are to be used. The mount shows no very novel features, being an improvement on former types. The training and elevating gears are so arranged that the

wheels are together and are worked by the gun-captain, who can keep his eye on the sight and manipulate the gun.

The weight of the powder charge is from 45 to 50 per cent of the weight of the shell, the latter being 60 pounds. Recent trials of this gun gave the following results:

Charge (pounds).	Pressure (tons).	Velocities (f. s.)
16	5.7	2040
26	16.4	2990
27	16.95	3101
28	18.23	3221
28.5	19.3	3255

The powder used was a 6-inch smokeless powder, and as shown in the above table gave about 3000 f. s. with a chamber pressure of 16.4 tons. No tests for rapidity have been made but with aimed shots the gun can be loaded much more rapidly than is consistent with good shooting.

TRIALS OF U. S. ARMY 12-INCH GUN WITH MAXIMITE SHELL.—Some interesting experiments with maximite have recently been made at Sandy Hook. The exact composition of maximite is not given out but it is stated to be a picric acid mixture consisting mainly of a picrate. The products of its combustion are almost wholly gaseous, and as the heat developed is very great, and the gaseous volume large, its power when detonated gives it a high explosive value. It may be fused at 174° F. instead of 252°, which is the melting point of picric acid. If heated it first melts and then evaporates until it wholly disappears. A very remarkable feature is that in its unconfined state it cannot be heated fast enough to produce an explosion. Set on fire in the open air it burns like pitch, and an illustration in the *Scientific American* shows the inventor in the act of pouring molten iron on a mass of it.

The following is from the *Scientific American:*

"Among the first tests of this material by the Ordnance Board was the firing of a 5-inch armor-piercing projectile through a 3.5-inch, nickel-steel, armor plate. The projectile was recovered intact from the sand butt behind the plate. It was then armed with a fuse, buried in the sand, and exploded for fragmentation. The sand was sifted and over 800 fragments recovered.

"About the same time, a 12-inch armor-piercing shell was filled with maximite, buried in the sand, and exploded for fragmentation. More than 7000 fragments were recovered. Following this test, a 12-inch, armor-piercing, forged steel shell, containing 70 pounds of maximite, was fired through a 7-inch, Harveyed nickel-steel plate, and was recovered from the sand behind the plate. This 12-inch shell and the 5-inch shell above-mentioned were, of course, fired from the gun without a fuse, as the test was one for insensitiveness only, to ascertain if the explosive would stand the shock of perforation of armor plate.

"The next test was to fire a 12-inch, armor-piercing shell, carrying 70 lbs. of maximite, and armed with a fuse, through a 5.75-inch Harveyed nickel-steel plate. The fuse used in these tests is the invention of an army officer, and it has shown itself capable of standing the shock of penetration of armor plate as thick as the projectile itself will stand to pass through. But it is difficult to always get just the exact amount of delayed action, so that the shell will explode the moment it has passed through the plate, not either in the plate or 100 yards beyond. The time

is gauged to hundredths of a second. It is better to explode when half or two-thirds of the way through the plate than to explode too far beyond it. Hence it is preferable that the shell should go off a little too soon than too late. This 12-inch shell exploded when it was about half-way through the plate. The violent effect of the explosion upon the plate, shattering it into fragments, with the destruction of the abutment where it was supported, is shown in the accompanying photograph, in which the deep scoring of the shell should be noted.

"It should have been stated that preceding the last two tests above-mentioned, something like half a dozen six-pounder armor-piercing shells filled with maximite, and without a fuse, were fired, in competition with shells similarly filled with fused picric acid, against plates of varying thickness. The picric acid detonated on impact when fired at a plate 1.5 inches in thickness, while the maximite shells, of course, did not explode. The maximite shells were then fired at a plate 3 inches thick, some of them passing through and others sticking in the plate. A photograph shows the points of two of these shells, one just through the plate, and the other about half way through. None of the maximite shells exploded, and they still remain in the plate, filled with the explosive. One of the maximite shells which struck this plate penetrated about half way through, upset so that it was shortened nearly two inches, and burst open at the side, the unexploded maximite being forced through the rupture, and the shell rebounded from the plate about 200 feet and struck in front of the gun without exploding. In an accompanying photograph this distorted shell is shown beside one in its original shape and length.

"Perhaps the most remarkable of all these tests that have been made at Sandy Hook were the last three, as described below.

"On May 1st a 12-inch, armor-piercing projectile, carrying 23 pounds of maximite, was fired without a fuse through a 30-ton Harveyed nickel-steel plate, 12 inches thick. The shot was recovered in perfect condition, its load of explosive having stood this terrific shock without explosion.

"Following this test, a similar shot, also holding 23 pounds of maximite, and armed with a fuse, was fired through the same plate, exploding when about two-thirds through, the fuse being about two-hundredths of a second too quick. Two photographs show the abutment before and after the projectile exploded in the plate, the second showing the plate broken, the fragments strewn around, and one, weighing several tons, resting upon the top of the structure.

"A very interesting test was the last one of the series, and which took place on Tuesday, the 7th instant (May, 1901), when a 12-inch mortar shell, known as the torpedo shell, was fired from a 12-inch sea-coast rifle at full velocity and pressure, with a charge of brown prismatic powder. This shell carried 143 pounds of maximite, was armed with a fuse and fired through a sand crib faced with heavy timbers. The velocity of the projectile was probably about 2100 feet per second, and, as the column of explosive was four feet long, the shock of acceleration upon the maximite must have been very severe, although not comparable, of course, with the shock on even a much shorter column in penetrating heavy armor plate. This was the largest charge of high explosive ever thrown from a powder gun in a service shell, and at service pressure and velocity. The projectile exploded just as it emerged from the back side of the crib. It was broken into very small fragments, averaging from the size of a rifle ball to several ounces. A crow and a ground sparrow were

struck upon the wing and brought down from the sky by the flying fragments, and fell near the sand crib, the sparrow falling directly into the crater, a result which suggests the completeness of the fragmentation."

ARMSTRONG GUN ACCIDENT.—[See PROCEEDINGS *No. 97*, page 204.] We learn that the particulars given in a letter by "Verax," *re* an accident to an Armstrong gun on board the Terribile, of the Italian navy, and published in our issue of March 1 are totally inaccurate. There was, it is true, an accident to the breech, but it arose from the charge exploding before the breech was closed. "Verax" asserted that the breech blew out owing to weakness of the screw, and to lend "corroborative detail to a bald and unconvincing narrative," proceeded to affirm that Messrs. Armstrong had, after a similar accident in 1890, modified the design of the screw. This, we find, is quite incorrect, the only changes made in the screw since its first introduction, having been in details connected with new firing gear or mechanism.—*Engineering*, London.

MORTARS AND HOWITZERS.—High angle fire is at present falling out of favor. This is not surprising. Why it was ever highly regarded is the proper subject for wonderment. The object of a gun is first to hit and then effect damage upon the enemy. The chances of hitting stationary objects with high angle fire are very small; when the object is moving at unknown and variable speeds and at imperfectly known distances the chances become very small indeed. Now as to probability of serious injury if the hit is achieved. In guns of high velocity and flat trajectory the projectile has a high speed of rotation sufficient to keep it moving point first. When the velocity of rotation falls to a certain point the shell will "tumble." In rifled mortars the rifling is useless as regards steadying the projectile at the end of its flight and perhaps serves no useful purpose whatever. The rotation of the projectile is probably insufficient to preserve the direction of the axis long before the shell reaches its maximum altitude (elevations in excess of 30° presupposed). It then falls tumbling. If it strikes with its point down and axis inclined at less than 45° with the vertical it may have some penetrative force due to the point, but probably would not—if tumbling rapidly—unless its axis on striking was within 15° or 20° of the vertical. If the shell had no rotary force left and fell freely along the second half of its trajectory, a specially dense and heavy head and light and long body might cause it to come down point first. But the feeble remaining rotation would probably prevent this in ordinary howitzer shell, so that we may presume the projectile falls freely. With a freely tumbling the chance of its hitting point down and within 45° of the vertical is 1 in 6.7. The actual probabilities are likely to be better than this as the weight and shape ought to exercise some effect, possibly improving the chance to 1 in 5. Its velocity is feeble, however, and unlikely to make it go through more than one or two decks. The 8.2-inch howitzer shell which hit the Indiana (a purely accidental hit, at night and at an unknown distance—indeed, it was not even fired at her) went through the flash plate and the deck plating beneath, struck the protective deck and exploded. The protective deck was scarcely dented.

In regard to the probability of striking the object at which the howitzer or mortar is firing General Miles stated before the sub-committee on appropriations:

"They are not being constructed by any government in Europe. They have never been tried in war, and our experience in the Spanish War was

that the guns in barbettes at San Juan were able to stand off our fleet without the assistance of either disappearing guns or mortars. The mortars have never been tested in actual warfare, and to only a limited extent in target practice." General Miles said: "As to mortar projectiles, the theory is that they will go up in the air and come down point first and go through the deck. They will not do anything of the kind. In coming down they strike either base-end first or on the side.

"A striking illustration of the inaccuracy of mortar fire was given in France some ten years ago. In order to test the comparative protection from vertical fire afforded by the German coast-defense turret and the standard French turret, it was decided to make a practical trial. An 8-inch rifled mortar was used. The two turrets were erected at a distance of 2000 yards from the mortar. The test was finally abandoned, because after firing for more than a month and using hundreds of rounds of ammunition in the attempt not a single shot had struck either turret."

A mortar projectile does not penetrate unless it comes point down and there is nothing to compel them to do so. "A projectile out of a high-power gun is going point on, and you know if there is a battleship anywhere within a mile in the line of fire that battleship is going to be struck. But, on the other hand, the mortar sends its projectile up into the air and it then comes down somewhere. If the ship happens to be under it it will strike it, but whether it will do it any harm or not I do not know; if not, there is just so much money thrown away."

TESTS OF U. S. SEA-COAST MORTARS.—The artillery members of the Board of Ordnance and Fortifications met in New York Friday, May 16, for the purpose of arranging the details for the coming test of 12-inch mortars to be held this summer at Portland, Maine. This test will, for many reasons, be exceedingly interesting. It will decide, once and for all, the merits of the mortar as an engine of warfare for coast defense. Over 200 shots will be fired from the mortars at a target about 2000 yards distant. There are now sixteen of these large mortars at Portland, and the general conditions there are exceedingly favorable for the test. The mortar still has many strong adherents in the army, but a majority of artillery officers have a poor opinion of its worth. The result of the test, which will be exhaustive, will be awaited with much interest.—*Army & Navy Journal.*

BROWN SEGMENTAL GUN TESTS.—The powder tests of the 10-inch Brown segmental wire-wound gun which began on February 21, at the Sandy Hook proving grounds, were completed on Thursday, March 7. General Miles, Gen. John M. Wilson, Gen. Thomas J. Henderson and Col. John I. Rodgers, members of the Board of Ordnance and Fortifications, and Capt. Isaac N. Newton, the recorder of the Board, were present. Six shots were fired, using up the 850 pounds of smokeless powder on hand for the test. A slight defect in the welding of the "field shield" or outer sheath of the gun tube developed after the first shot had been fired on February 21, and the test was postponed in consequence. This outer wrapping had been welded at a steel plant without necessary facilities, the better equipped plants being unable to undertake the work on account of press of orders.

While the members of the board naturally did not express an opinion as to the merits of the gun in advance of their report, the gun company report that the six shots left the gun unstrained. A maximum pressure of 37,300 pounds to the square inch was developed, with a velocity of 2500

feet a second. No United States Army gun of the same or greater caliber has, it is said, ever attained such velocity before.—*Army & Navy Journal*, March 9.

At the recent meeting of the Board of Ordnance and Fortifications a letter from the manufacturers of the Brown wire-wound gun, in which it was requested that permission be granted to enlarge the chamber of the 10-inch gun, was considered and approved. The gun as now chambered is intended for nitroglycerin powder, but as this country has decided not to use this kind of powder it has been found necessary to enlarge the chamber of the 10-inch gun in order to get the necessary velocity of 2800 feet per second.—*Army & Navy Journal*, April 20.

BELLEISLE: REFITTING FOR NEW EXPERIMENTS.—The preparation of the Belleisle for the next series of experiments has commenced. The following is the program, which will take two or three months to complete: On the port side, plates of 4-inch Krupp armor, similar to that supplied for the Essex class, will be placed. On the starboard side, 6-inch Krupp armor, identical with the Drake's plates. These plates will run along the lower deck for some distance both before and abaft the redoubt. The old flat armored deck of the Belleisle is being removed, and a 2-inch turtle back will be substituted. This will reinforce the 4-inch and 6-inch plates in places—elsewhere it will be behind unprotected sides, as the ship will be submerged sufficiently for the old belt to be under water. The virtue of deck protection, pure and simple, will also be tested. As, all told, the world has built several hundred cruisers on this system, it is, perhaps, time to try and gauge its value. It seems, however, to have been left to the much-abused British Admiralty to think of this.—*Army & Navy Journal*, April 13.

INFANTRY FIRE VERSUS MACHINE GUN.—From trials recently made at Querqueville, near Cherbourg, it has been deduced that one machine gun served by two men will develop as much effective fire action as 200 rifles. Fifty marksmen were chosen from the Colonial Infantry to compete with the Hotchkiss 8-millimeter gun which has lately been adopted for the French Alpine troops. The ranges fired at were 400 and 750 meters. At 750 meters distance (820 yards) the fifty riflemen, firing each five rounds independently, obtained 54 hits, or 22.6 per cent of the number of rounds fired. Thirty-two men were then chosen from among the fifty, and these had to fire each eight rounds in 30 seconds. Under these conditions 34 hits, or 13.3 per cent of the rounds expended, were recorded. The machine gun was then brought into action, and in 38 seconds fired 211 bullets, making 145 hits. Needless to say, these results are greatly in favor of the machine gun, and further tests led to the conclusion being arrived at as already stated.—*Arms & Explosives*, May, 1901.

FIRING AT A SUBMARINE BOAT.—At Lorient dockyard, France, trials are to be made of a caisson, constructed to represent the submarine boat Gymnote, which is to be subjected to the plunging fire of light guns from ships—the idea being to ascertain if these would be effective against submarine boats navigating awash or seen just below the surface.—*Army & Navy Gazette*, London.

MODERN GUNSHOT WOUNDS.—Dr. E. F. Robinson, in "Annals of Surgery" for February, thus sums up his conclusions in an article on gunshot wounds in the Philippine war: 1. The modern gunshot wound is generally aseptic, and should be treated on this supposition. 2. Asepsis is due chiefly to the character of the bullet and the early application of

first-aid dressing, and, in a minor degree, to the velocity of the projectile. 3. Primary hemorrhage from modern gunshot wounds is exceedingly rare, the blood vessels being displaced rather than cut by the rapidly moving projectile. 4. The "explosive effect" of the modern bullet is much less common than recent military literature would indicate. This peculiar destructive effect is produced by the character of the tissue struck, as well as by the great velocity of the bullet. 5. Gunshot wounds of chest are rarely infected. Simple antiseptic treatment, with aspiration of pleura in cases of severe hemorrhage, is all that is necessary. 6. Gunshot wounds of knee-joint are usually aseptic, but, if infected, demand immediate amputation to save life. 7. Excision of elbow is always a justifiable operation in severe shattering or infection of that joint. Resection of bones of other joints is rarely necessary, erasion or amputation being preferable. 8. Injuries of nerves from gunshot wounds can often be benefited by operative interference or resection. 9. In modern military surgery abdominal section for gunshot wound is not justifiable; the patient's best chance of recovery lies in conservative treatment without operation.

A. Horman, M. R. C. S., in the *Intercolonial Medical Journal* in an article on "Surgical Experiences in South Africa," says: "It may be of some interest from a medico-legal point to notice the effect of a grazing wound. It gives the appearance as if the skin had been burned by a hot iron laid upon the skin; this is due to the removal of the superficial epidermis, exposing the true skin, which becomes brown after a few hours."—*Army & Navy Journal.*

GUN MOUNTS.

STRAUSS GUN BEARINGS.—A recent English patent has been taken out by Lieutenant J. Strauss, U. S. N., on improvements in gun bearings. The brief of the patent is given as follows:

The gun bearings described in this specification are constructed so that they have every capacity for withstanding the shock of recoil, and yet offer the smallest possible resistance from friction to the turning of the gun in elevating or depressing it. The ordinary trunnions are used, and are mounted in the usual way. These take the shock of recoil; but from the faces of these project supplementary trunnions, which have ball-bearings. There is thus only rolling friction in the moving of the gun to elevate or depress it. Accepted March 24, 1900.

NEW SECTIONAL RAMMER.—A sectional rammer recently patented by Sir W. G. Armstrong, Whitworth & Company and C. H. Munroe, Newcastle-on-Tyne, seems to offer some advantages. The rammer consists of steel troughs (such as might be made by sawing a number of concentric hollow cylinders into two equal parts longitudinally). The edges of the troughs are up and all lie in the same horizontal plane. The edges all carry precisely similar geared racks. At the front end each trough stops a little short of the one inside of it. A transverse geared shaft long enough to reach across the widest trough is placed just in rear of the position of the head of the rammer which is on the inner trough (this is really only a bar—the other sections are troughs) when the rammer is drawn fully back. Upon actuating the transverse shaft, its gear first draws out the inner bar carrying the rammer head. When this reaches

its full travel to the front it becomes locked in place in the head of the next outer trough which latter is drawn forward until its teeth engage in the gear on the shaft, and so on. When the rammer is withdrawn each section is pulled to the rear in turn and unlocked when the preceding section is fully home.

INSTRUMENTS USED IN ACTION.

NOTE.—Under this head will be given notes on searchlights, range-finders, stadimeters, torpedo directors, etc.

RANGE-FINDERS.—In our service the apathy shown towards developing a proper system of range determination is deplorable and it is surprising in view of the attention paid to target practice. The inaction is due partly to a distrust of range-finders, both as to reliability of operation and precision; partly to lack of thought on the subject; but more than all to a belief that ranges can be guessed by trained marksmen or determined by the fall of projectiles.

Considerable experience in training men to estimate ranges has convinced me that the average man can guess distances of objects within 500 yards when they are not more than 2000 yards away, but beyond 2000 yards his estimates are very wild, the error short often exceeding 50 per cent, and the error over frequently exceeding 100 per cent of the known distance. With our present service guns (giving a velocity of 2300 f. s. with smokeless powder) an error of 500 yards in range corresponds to a vertical error of about 15 feet at 2000 yards for 6-inch guns—slightly more for smaller calibers and slightly less for larger ones. In other words, if the gun be pointed a little below the center of a vertical target 30 feet high, and other sources of error be neglected, an error of 500 yards in range will cause the point of the projectile to strike just at the upper or lower edge, according as the estimated range is too great or too little. With our new 6-inch guns (Model '99, muzzle velocity 2900 f. s.) an error of 500 yards in a range of 2000 yards will cause the projectile to miss a vertical target 13.5 feet high. At 3000 yards the vertical target for 500 yards' error is about 20 feet high for the new 6-inch gun; for the old 6-inch with 2150 f. s. the vertical target under these conditions is 37 feet and with 2000 f. s. it is 42 feet.

It is evident that if we have certain large unknown errors which we do not allow for, and for which the gun firer does not correct his aim, then the better the training of the gunner the less is he likely to hit. If he were a perfect shot he would never hit the target at all if furnished with a range sufficiently erroneous, whilst a poorer shot would hit occasionally.

Now this is manifestly wrong. Our training should not be worse than thrown away. We must reduce large errors to small ones, or else determine them exactly. Under the present conditions by far the largest error in gun-pointing is due to error in range, and I see no evidence on any hand of an attempt to improve this state of affairs. It was the cause of the waste of ammunition at Santiago and perhaps in our next war it will be the cause of a crushing defeat.

I have referred to the error of estimating ranges. I forgot to say that these errors were made by men who were unexcited, calm, intent simply upon guessing the distance and with their field of view unrestricted.

What the results would be under unfavorable circumstances of battle I cannot say, but certainly the men could not guess so well.

Now as to the possibility of getting the range by the fall of projectiles. In my opinion this does not exist at any ranges unless you are willing to sacrifice all that we have gained in rapidity of fire in a quarter of a century. It is one of those ideas left over from the age of muzzle loaders, perpetuated by an unthinking consideration of target practice and a lack of appreciation of battle conditions.

At the battle of Santiago, in the heat of the action, two hundred shells per minutes of various calibers were striking the Spanish ships or falling about them and were chiefly directed against one ship at a time. It was not possible to tell where any particular shot came from nor whether your own shell fell short or went over. Ranges were constantly received from an officer in the top but they were nearly always useless, for it was not certain which ship was—or rather had been—at the range reported; and the interval between the taking of the range and its report at any particular group of guns constantly varied. Moreover, the changes of direction and of speed added further difficulties to a complicated situation. All this would have been saved by having separate range-finders for each group of guns.

In single ships actions in which the ships engaged are small, guns few and readily controlled by one person without serious sacrifice of speed of fire, it may be practicable to correct the range by the fall of projectiles, but in all other cases, *No*—a thousand times No! And it is unnecessary that it should be. We can train the gunner to know his gun and the motions of his ship, and to be able to allow for most of their idiosyncrasies, only when he is furnished with correct distances of the target. Having trained the gunner so that he has such command over his firing that he can hit an ordinary target at a reasonable known range, it becomes necessary, in order that we shall benefit by his training, that the correct range shall be supplied him in battle.

The only acceptable range-finder is one of the auto-base type. Two such are described in "Notes on Naval Progress" (office of Naval Intelligence, July, 1900). Their errors at various ranges are interesting and do not bear out the statement one often hears to the effect that range-finders are too inaccurate to be of any use. The Barr and Stroud range-finders gave the following:

Range (yds.)	326	1975	5950
Mean error (yds.)	0.04	3.3	25.0
Extreme error (yds.)	0.40	15.0	50.0

The errors of the Zeiss stereoscopic range-finder are thus reported:

Range (meters) 500	1000	2000	4000	8000
Mean error (meters) —	5	18	70	280

On a vertical target, with our new guns, these errors of range would be wholly negligible. They would not displace a 6-inch shell by an amount equal to its caliber at a range of 2000 yards. In the face of such results how shall we characterize attempts to obtain range by estimation or guess? Doubtless to keep the errors of observation as low as those recorded in the tables here quoted some training of the observer is necessary. But if only a small fraction of the time that is spent in

training a gun-pointer is devoted to training a range-finder man, he will probably be a skilled observer. In examining and testing such instruments many people are prone to reject them because they cannot at once be used with full success and perfect ease.

To obtain all the advantages of the use of range-finders they should be numerous. One should be supplied to every group of guns (also some spare ones to replace those injured) so that the range may be furnished promptly at the moment desired and so that there can be no doubt that the pointing and ranging are for the same ship of the enemy's fleet. One range-finder man with one or two assistants should supply distances, speeds, and courses of the enemy—for of course this is easily possible with good range determination. Such an allotment as here described would require ten or fifteen instruments for large ships, exclusive of the spare ones. And in no other way will a hundred times the expenditure add so much to the power of our fleet.

It is urged that all the range-finders so far installed are easily thrown out of adjustment and will not stand the shock of firing. So far as I have seen this is not true of late models which are about as reliable as telescope sights. Both require reasonable care.

FISKE TURRET RANGE-FINDER.—Lieutenant-Commander B. A. Fiske, U. S. N., has taken out patents in the United States and Great Britain of which the claim is as follows:

CLAIM.—(1) The combination with a revolving turret, of an optical range-finder carried thereon and constituting a permanent fixture thereof, whereby the range-finder will be trained on the target by the rotation of the turret, said range-finder comprising a telescope and two reflectors, said reflectors being secured at approximately the opposite ends of a diameter of the turret, which diameter thereby constitutes the base line of the finder, and means for vertically aligning the rays which come from a distant object to said opposite ends of the base line, substantially as set forth. (2) The combination with a revolving turret, of a range-finder carried thereby and comprising a telescope, the eyepiece of which is out of line with its objective, said telescope being mounted near one side of the turret and through which the target is observed directly by the observer within the turret, a reflector mounted opposite said telescope and by means of which a reflected image of the object will be observed through the telescope, and means for adjusting the angle of said reflector, substantially as set forth. (3) The combination with a revolving turret, of a cross bar pivoted to said turret, a vertical telescope carried by the cross bar and projecting downward into the turret, a reflector carried by said telescope, a reflector carried by the cross bar at its opposite end from the telescope, and means for adjusting the angle of the latter reflector, substantially as set forth. (4) In a range-finder, an observing telescope movable relatively to a fixed pivot, with the eyepiece of the telescope in approximately the line of said pivot, whereby the adjustment of the telescope to maintain an object in the field of view does not effect a relative movement of the eyepiece, substantially as and for the purposes set forth.

SEARCHLIGHTS AND TORPEDO BOATS.—Searchlights are liable to play an important part in the warfare of the future, and the recent manœuvres in the Mediterranean demonstrated that the projectors would be an effective means of defense if properly used, but that very careful consideration should be given to the position from which they are used, and a writer in

the current number of the *Electrical Review*, in an article on the use of searchlights in naval warfare assumes that in the case of a fleet steaming in company on a dark night and attacked by torpedo boats, the only means of defense would be to turn all the searchlights on and endeavor to repel the attack by a sharp gun fire, and that under these circumstances the chances are in favor of a successful attack, although several of the boats may be put out of action. What he does not take into account is that the fleet would almost certainly be accompanied by destroyers fitted with searchlights close to the water's edge. The fleet would stand a much better chance than he opines if the destroyers accompanying it used their searchlights, and the battleships their quick firing guns. The writer, however, gives an interesting account of some experiments which were made on the supposition that a ship lay temporarily disabled and at anchor in a port, and the means of defense adopted when she was attacked by torpedo boats. Two torpedo boats entered the harbor and discharged their torpedoes almost unobserved, although they had actually to pass through the beam of a searchlight at the entrance before they could get in at all. The searchlights on the water completely destroyed the vision of the occupants of the boats while in the ray, but the higher placed light, while giving a better target for the gunners, at the same time indicated the ships' position to the attacking boats. Colored glass shades were used by those in these boats with advantage by reducing the dazzling effects of the higher placed projectors, but they were of little use against the lower searchlights. The whole problem involves itself into this, that the gunners of the ship attacked, to insure good practice, should be as far removed as possible from the searchlight.—*Marine Engineer*, London.

SMALL ARMS.

LEE-PUDNEY RIFLE.—Messrs. S. Lee and R. C. Pudney have patented a rifle in which the principal novelty is a down-feed magazine on top of the breech. It is a bolt gun with handle at rear end of bolt, and requires the usual rotation of the bolt to release it.

NEW SWISS SHORT MODEL RIFLE FOR SPECIAL SERVICE.—The *Allgemeine Schweizerische Militarzeitung* of March 16 (1901) informs us that the troops of artillery of position (fortress, garrison, etc) companies of telegraphers, of balloonists, and of cyclists will be armed with a short rifle, caliber 7.5 millimeters, of which the systems of breech mechanism and of ammunition are the same as those of the model adopted for the infantry rifle, and which is designated as the "short model rifle 1889-1900." The new model differs from the infantry piece in the following particulars:

(*a*) The length of the barrel is the same as that of the cadet gun (593 millimeters = 23.3 inches). The total length of the piece is 8 inches shorter than the infantry arm.

(*b*) The weight of the short piece is 7.82 pounds; that of the infantry is 9.46 pounds.

(*c*) The magazine holds 6 cartridges.

(*d*) For the short gun the same sword bayonet is supplied as is on the gun used by the engineer troops.

As to other points the piece approaches closely the infantry model.

Up to ranges of 1000 meters its accuracy is nearly as great. By the adoption of a short gun, it has been sought to lighten the weights carried by troops which, while working, carry their rifles slung over the back. It will be sufficient, for a detachment left to itself, to protect it against surprise by the enemy's cavalry. The distribution to the designated special troops will commence very soon.—*Revue du Cercle Militaire.*

LUGER AUTOMATIC PISTOL.—The Board of Ordnance and Fortifications, as predicted, has recommended that $15,000 be allotted for the purchase of 1000 of the Luger automatic pistols, which recently made such a wonderful record in the tests at Springfield Armory. The sum allotted—for the recommendation of the board was instantly approved by the Secretary of War—is sufficient to furnish five of these pistols to each troop of cavalry in the service and as these troops are serving at the present time under the most varied conditions, this distribution will insure a thorough practical test of the arm. The commanding officers of the cavalry troops will be ordered to make a general report on the merits of the Luger pistol. In addition they will be directed to answer specifically the following questions relative to the pistol in actual service:

1. The advantages and disadvantages of automatic pistols as compared with the revolver. 2. The advantages and disadvantages of this particular arm as compared with the revolver. 3. The advantages and disadvantages of this pistol as compared with other automatic pistols. 4. The suitability of automatic pistols for the use of enlisted men. 5. If not deemed suitable for use by the enlisted men as a whole, would it be advisable to issue them for the use of officers and non-commissioned officers?

The results of this practical test will be of far-reaching importance, as they will determine whether our troops are to be armed with the latest development in the way of small arms or are to continue to use the old fashioned cylinder revolver.

At the recent tests of the pistol at the Springfield Armory thirty shots were fired from the Luger in about 15½ seconds, a rate of fire of 116 shots a minute. As the magazine holds but eight cartridges, this means that the magazine must have been replaced three times, starting with the arm loaded. This is double the rate of fire obtained from any other automatic pistol. The arm may be completely dismounted for cleaning in 3½ seconds.

The Luger pistol has been adopted by the Swiss government and the army of that country is now being supplied with the pistol from Berlin, but it is more than probable that if this government should adopt the weapon the rights to its manufacture will either be purchased outright or a royalty will be paid for its manufacture in this country, as was done with the Krag-Jorgensen rifle.—*Army & Navy Journal.*

TORPEDOES.

TORPEDO TUBES REMOVED FROM BRITISH CRUISERS.—The above-water torpedo tubes of the Grafton and Hawke have been removed, leaving only the submerged tubes. It is reported that all above-water tubes are to be removed from British ships as occasion offers.

ANTI-SUBMARINE ATTACK.—In the British navy considerable attention is directed towards plans for neutralizing or driving off submarine boats. In the opinion of many officers the best weapon to employ against the submarine boat is the spar torpedo worked from torpedo boats or large vedettes. Something can doubtless be done in this direction but a submarine boat is small and battleships and seagoing torpedo boats are large, and it may be difficult to "catch your hare." Furthermore, if a boat is near enough to use a spar torpedo effectively it would seem possible to use guns with deadly precision. If the submarine boat is too far submerged to be fired at she is not likely to be seen.

BOOK NOTICE.

The "Modern Seamanship" by Lieut. Commander Austin M. Knight, U. S. Navy, and published by D. Van Nostrand Co., New York, will be welcomed most warmly by the naval service and merchant marine—the need of a book on modern seamanship having been felt seriously for some years.

This book covers a wide field, is very complete,—and the science of seamanship for both steamers and sailing vessels is thoroughly outlined and clearly illustrated.

The title, "Modern Seamanship," is happily selected, for although the book contains all the information required for rigging and handling sailing vessels, yet its main features are devoted to steam vessels, and it contains all the information required by the modern seaman.

This book represents many months of incessant labor and research, as well as many years of practical experience, and the author deserves genuine congratulations upon this splendid treatise as the result of his work. The book is ably written and illustrated, and will soon take standing as the American authority on modern seamanship.

E. W. E.

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